MOE/CAEAL PRE-MISA LABORATORY ASSESSMENT

SEWAGE TREATMENT PLANT EFFLUENT

TRACE METALS

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TRACE METALS

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MOE/CAEAL PRE-MISA LABORATORY ASSESSMENT

Sewage Treatment Plant Effluent

Trace Metals

Abstract

This interlaboratory study was commissioned by the Ontario Ministry of the Environment (MOE) under RAC Project #514G to evaluate the capability of labs to measure metals in sewage treatment plant effluents.

The overall administration of the study was carried out by the Canadian Association of Environmental Analytical Laboratories (CAEAL). The technical aspects of the study including sample preparation, sample distribution, and data evaluation were carried out by the National Research Council (NRC) in Ottawa.

The purpose of this exercise was to assess the capabilities of a number of analytical laboratories in Ontario to analyze sewage treatment plant (STP) effluent for trace metal concentrations with respect to future regulatory needs of the Ontario Ministry of the Environment (OME) regarding the Municipal and Industrial Strategy for Abatement (MISA) program. This study involved thirteen metals recommended by OME (Be, Al, V, Cr, Co, Ni, Cu, Zn, Mo, Ag, Cd, Tl and Pb) along with suggested minimum concentration values for each metal.

A set of 4 samples were prepared with varying concentrations of the target metals. These samples were submitted to 48 municipal and commercial laboratories for analysis.

75% of participants responded with complete data (36 of 48) which was then statistically evaluated for accuracy, precision, individual and group lab performance.

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1. INTRODUCTION

The purpose of this exercise was to assess the capabilities of a number of analytical laboratories in Ontario to analyze sewage treatment plant (STP) effluents for trace metal concentrations with respect to future regulatory needs of the Ontario Ministry of the Environment (OME) regarding the Municipal and Industrial Strategy for Abatement (MISA) program. This study involved thirteen metals recommended by OME (Be, Al, V, Cr, Co, Ni, Cu, Zn, Mo, Ag, Cd, Tl and Pb) along with suggested minimum concentration values for each metal.

Two hundred litres of chlorinated sewage treatment plant (STP) effluent were collected from the final settling tank of the Robert O. Pickard Water Treatment Plant in Gloucester Ontario. The chlorinated sample was peristaltically pumped through precleaned plastic tubing and simultaneously filtered by three Gelman cartridge filters in series (3 μm, 0.45 μm, 0.2 μm). The filtration of the suspended material was deemed necessary in order to ensure the stability of the trace metals in solution and the preparation of a homogeneous sub samples. The sample was immediately acidified after filtration to pH 1.6 with sub-boiled distilled nitric acid.

The 200 litre sample was returned to the laboratory and analyzed to determine its trace metal content for the 13 metals of interest. It was then divided into four portions, three of which (Samples B, C and D) were spiked to approximately the desired levels shown in Table I on the next page using high purity metal solutions. The samples were bottled in precleaned 500 mL polyethylene bottles.

The metal concentrations of Sample B (except for Al and Zn) approximate the OME suggested minimum concentrations for this exercise. The concentrations of Al and Zn in Sample A were already higher than the suggested values for these two metals. The concentrations in Sample D represent reasonable maximum concentrations found in studies of Ontario STP effluents by the MISA office for most of the 13 metals. Sample C concentrations were set between those of Samples B and D. It was obvious that the concentrations of many of the metals in the original solution (Sample A) were very low and lower those necessary for the stated purposes of this exercise. However, this laboratory of the National Research Council (NRC) has a long and ongoing interest in laboratory capabilities in Canada and decided to include Sample A in this study. Laboratory results for Sample A (except for Al and Zn) were not used in the laboratory evaluation described later in this report.

It was also recognized that in filtering the collected STP effluent a sample was created with a less complex matrix than would be normally encountered since it was depleted both in inorganic and organic particulates.

Each participating laboratory was shipped one set of each of the four samples. An offer of an additional set of samples was made, if it was required. The participants were also sent data

sheets on which to record their results, procedures, limits of detection, and whether they normally analyze STP effluents for the particular elements of interest (Appendix C).

Each laboratory was requested to perform five replicate analyses of each of the samples using any technique of its choice.

In order to provide benchmarks for accuracy for each of the metal concentrations this laboratory (NRC) also analyzed each of the samples by two analytical methods. Wherever possible, one set of results was produced using isotope dilution inductively coupled plasma mass spectrometry (IDICPMS). This technique, used correctly, is capable of producing very accurate analytical results. This is not to infer that the NRC laboratory is infallible, but it does have a long and successful track record regarding analysis for trace metals and the production of certified reference materials for trace metal analysis.

TABLE I
Target Concentrations, mg/L

Element	Sample B	Sample C	Sample D
Be	0.0001	0.0005	0.001
Al	0.110	0.64	2.2
V	0.010	0.030	0.093
Cr	0.012	0.018	0.050
Co	0.008	0.015	0.028
Ni	0.030	0.240	0.730
Cu	0.012	0.087	0.190
Zn	0.050	0.240	1.05
Mo	0.010	0.019	0.031
Ag	0.002	0.006	0.008
Cd	0.002	0.012	0.018
Tl	0.001	0.005	0.010
Pb	0.022	0.060	0.120

2. RESULTS

Samples were sent to the forty-eight laboratories listed in Appendix A on November 16, 1990 with the deadline for receipt of results set for January 7, 1991. Results were received from only thirty-six participants even after a one week extension of the deadline. This 75 percent response is rather disappointing considering the resources invested in this exercise. Each responding laboratory was assigned a number when its data were received. Laboratories 20 and 31 submitted results for only two replicate analyses. These are listed in Appendix B but were not included in the evaluations so there are only 34 sets to consider. Laboratory numbers 37 and 38 were assigned to the NRC results.

A copy of all the tabulated raw data was sent to each participant to verify that no errors were made in the transposition of the results. A small number of changes were made. The data used for all subsequent evaluation are listed in Appendix B. The data are listed as received with respect to significant figures and even the "0"s of one laboratory.

Each set of replicate analyses was examined using Dixon's test for outliers and the laboratory mean was recalculated excluding that result. For five replicates it is almost impossible to justifiably reject two values from the same set. There were 22 rejected results. A Dixon rejected value is marked with a "D".

If two or more "less than" values were reported in a set of replicates the mean was not calculated. However, all quantitative values are included in the graphs.

The overall mean concentration for each metal was calculated from the mean of replicates listed in Appendix B. These means were assumed to be normally distributed, which may not be a totally valid assumption for the very low concentrations. But it is felt that the assumption of normality was adequate for the purpose of this exercise.

A successively applied Student *t* test at the 95% confidence level was used to identify outliers. Means that were rejected are marked in both Appendix B and on the individual graphs on the following pages with an "*". All of the replicate data, including outliers, are plotted on the graphs where possible. A set of results outside the graph area is indicated with a "▲" and its mean is shown.

The horizontal lines represent the final excluded mean and the 95% confidence interval. In many cases the mean and confidence intervals for sample A were not calculated due to insufficient data, and no graph is shown. A short summary of results for each element in each sample is listed at the left of each graph. All uncertainties are 95 percent confidence limits.

BERYLLIUM

Sample A

Results: 23

Quantitative values: 0

Range:

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

Results: 23

Quantitative values: 4

Range: 0.0001 to 0.0005 mg/L

t test rejections: -

Mean: not calculated

No graph for sample B

Sample C

Results: 23

Quantitative values: 5

Range: 0.0004 to 0.001 mg/L

t test rejections: -

Mean: not calculated

No graph for sample C

Sample D

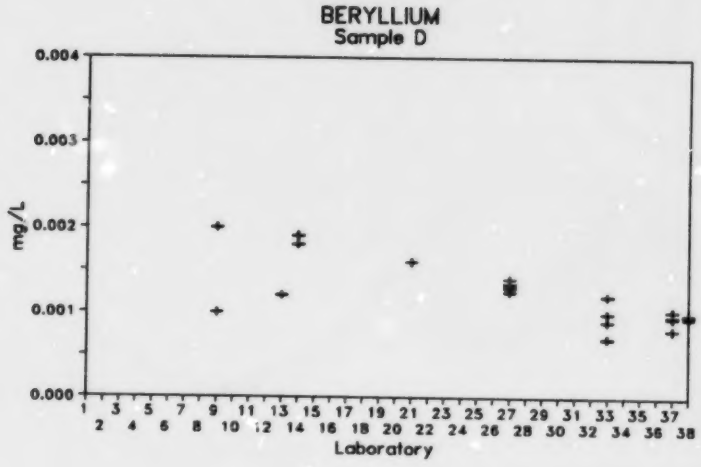
Results: 23

Quantitative values: 7

Range: 0.0008 to 0.002 mg/L

***t* test rejections: -**

Mean: not calculated



None of the participating laboratories submitted quantitative results for Sample A. Twenty-four of the 34 laboratories did list "less than" values, and all were correct if the NRC result (Lab 38) is valid. However a good number of these method detection limits (MDL) were 3 to 4 orders of magnitude greater than the NRC reported concentration.

Four laboratories (13, 14, 27, 33) yielded quantitative results for Sample B, all with good agreement near the target value for Be.

Five laboratories (9, 13, 14, 27, 33) yielded quantitative results for Sample C, three of which (13, 27, 33) were in good agreement with the target and NRC values, the other two (9, 14) being somewhat high but probably acceptable considering the Be concentration of about 0.5 µg/L.

There were insufficient quantitative data for Samples A, B and C to warrant drawing of the graphs.

Seven laboratories (1, 9, 13, 14, 21, 27, 33) yielded quantitative results for Sample D, five of which (1, 9, 13, 27, 33) were in good agreement with the target and NRC values, the other two (14, 21) a bit high but, again, probably acceptable considering the Be concentration of about 1 µg/L. A graph was plotted for Sample D but there were not enough results to calculate a reliable mean and confidence interval.

Were the MDL set at 1 µg/L for Be in STP effluents only eight of the laboratories could reliably detect its presence.

ALUMINUM

Sample A

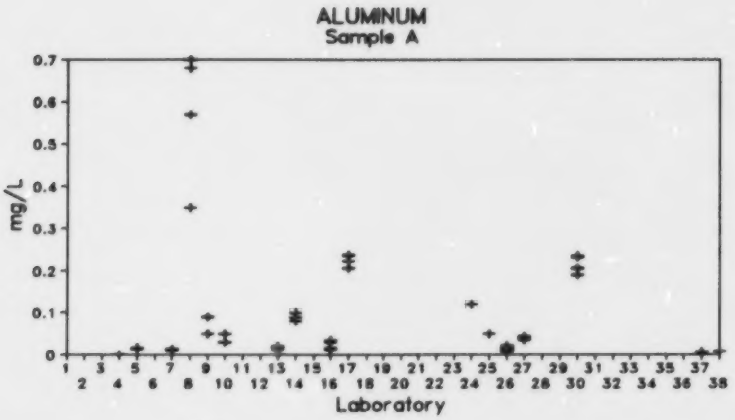
Results: 31

Quantitative values: 11

Range: 0.007 to 0.70 mg/L

t test rejections: -

Mean: not calculated



Sample B

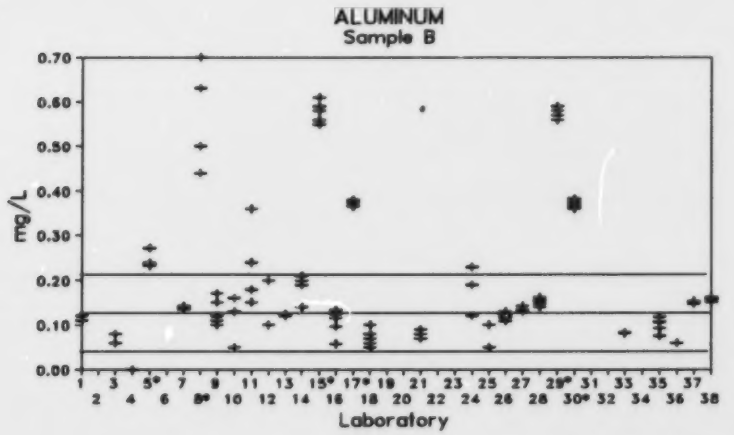
Results: 31

Quantitative values: 23

Range: 0.05 to 0.70 mg/L

t test rejections: 6

Mean: 0.127 ± 0.086 mg/L



Sample C

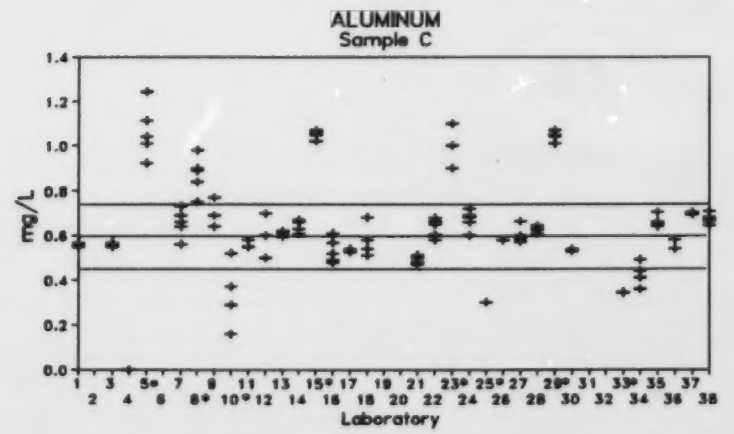
Results: 31

Quantitative values: 29

Range: 0.3 to 1.24 mg/L

t test rejections: 8

Mean: 0.594 ± 0.141 mg/L



Sample D

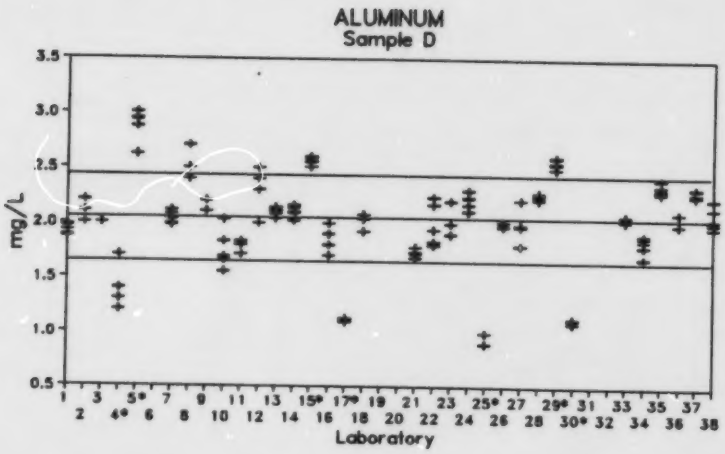
Results: 31

Quantitative values: 31

Range: 0.9 to 3.00 mg/L

t test rejections: 7

Mean: 2.06 ± 0.38 mg/L



Thirty-two laboratories submitted results for Al in Sample A, 11 of which were quantitative. We judge that only four of these (5, 7, 13, 26) are acceptable. Our experience has shown that it is very difficult to control contamination from ubiquitous aluminum at trace concentrations. Even the acceptable results for Sample A are high compared to the NRC values which were obtained from samples prepared in a clean room. A graph was plotted for Sample A but there were not enough results to calculate a reliable mean and confidence interval. We judge the true value to be about 0.01 mg/L.

The situation apparently improves dramatically for Sample B with 23 laboratories submitting quantitative results, 17 of which are incorporated into the final excluded mean. However, there is a large scatter of values with a resulting confidence interval ranging from 0.04 to 0.21 mg/L, a half an order of magnitude.

Samples C and D are each competently analyzed by about two-thirds of the participating laboratories. Twenty and twenty-four laboratories are apparently capable of producing results within ±20 percent of the accepted values of the respective concentrations.

Laboratories 5, 8, 15 and 29 are biased high for Sample B, C and D, while laboratories 17 and 30 are biased high for Sample B and D. Laboratory 4 is low for all 3 samples, reporting 0 (?) for Samples B and C. Laboratory 25 is low for Samples C and D by 50 percent. Is this an arithmetic problem? Results from laboratories 17 and 30 are strikingly similar, high for B and low for D.

VANADIUM

Sample A

Results: 26

Quantitative values: 7

Range: 0.001 to 0.129 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

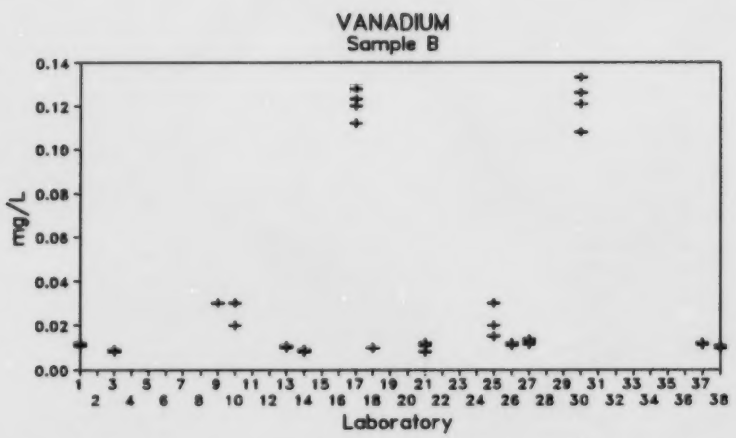
Results: 26

Quantitative values: 12

Range: 0.008 to 0.133 mg/L

t test rejections: -

Mean: not calculated



Sample C

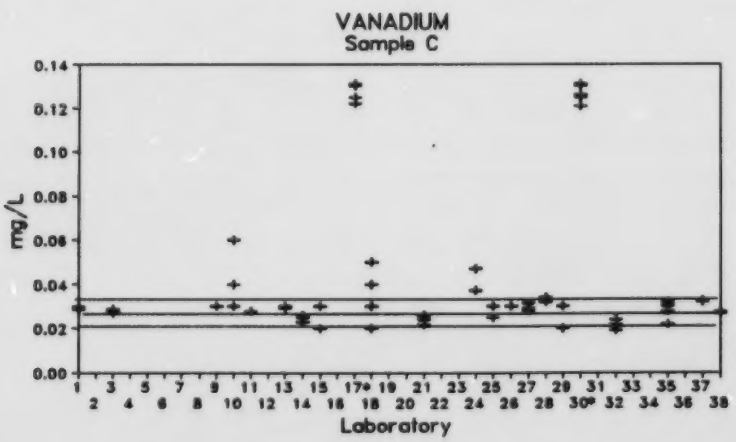
Results: 26

Quantitative values: 18

Range: 0.02 to 0.13 mg/L

t test rejections: 2

Mean: 0.0289 ± 0.0079 mg/L



Sample D

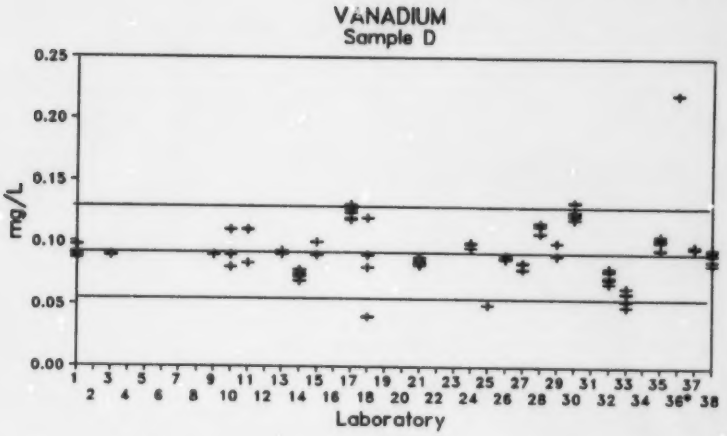
Results: 26

Quantitative values: 22

Range: 0.04 to 0.22 mg/L

t test rejections: 1

Mean: 0.0915 ± 0.0375 mg/L



Seven of twenty-seven laboratories reported quantitative values for vanadium for Sample A but there is little consensus among them and they are all higher than the NRC value. There were too few data to warrant plotting the graph.

Twelve laboratories submitted quantitative values for vanadium for Sample B. Seven of these (1, 3, 13, 14, 21, 26, 27) are in good agreement amongst themselves and the NRC and target value of 0.01 mg/L. It was felt that there were not enough results to calculate a reliable mean and confidence interval.

Eighteen and twenty-two laboratories submitted quantitative values for Samples C and D respectively. Oddly enough, the relative scatter is greater for Sample D whose concentration is 3 times that of Sample C. Laboratories 17 and 30, with similar values, are high by factors of 10 and 5 respectively for Samples B and C, and tend high for Sample D. Laboratory 22 is high by a factor of 2 for Sample D.

Fourteen and fifteen laboratories are capable of producing results within ±20 percent of the accepted concentrations of vanadiaum in Samples C and D respectively.

CHROMIUM

Sample A

Results: 34

Quantitative values: 5

Range: 0.0014 to 0.02 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

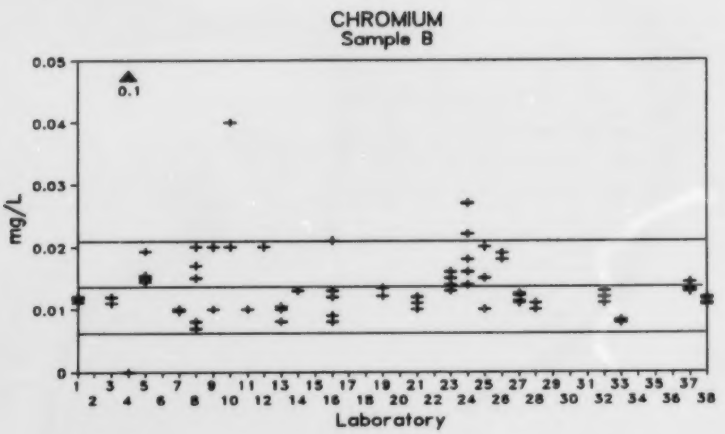
Results: 34

Quantitative values: 20

Range: 0.008 to 0.1 mg/L

t test rejections: 0

Mean: 0.0136 ± 0.0070 mg/L



Sample C

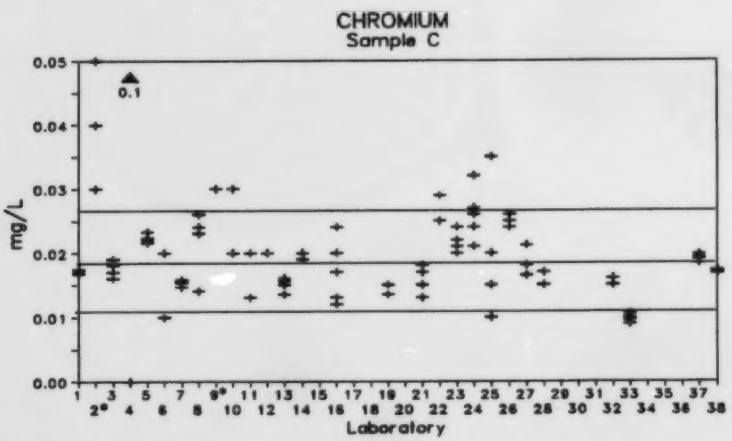
Results: 34

Quantitative values: 23

Range: 0.009 to 0.1 mg/L

t test rejections: 2

Mean: 0.0186 ± 0.0079 mg/L



Sample D

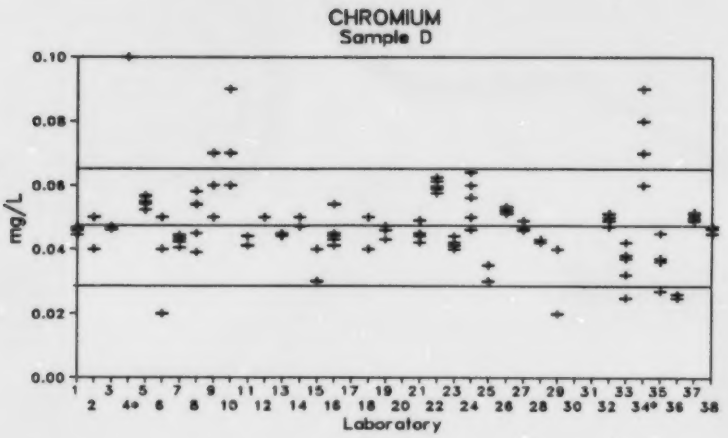
Results: 34

Quantitative values: 32

Range: 0.02 to 0.1 mg/L

t test rejections: 2

Mean: 0.0455 ± 0.0189 mg/L



Only five (1, 8, 19, 25, 26) of the thirty-four laboratories reported quantitative values for chromium in Sample A. The means ranged between 0.0018 and 0.010 mg/L with little consensus, at least an order of magnitude higher than the NRC value of 0.0002 mg/L. There were too few data to warrant plotting the graph.

For Samples B, C and D the picture is much brighter. Twenty, twenty-three and thirty-two laboratories reported quantitative results respectively for the three samples. Laboratory 4 appears to have problems yielding very high or very low results for the same samples. Laboratories 2 and 9 are high for Sample C.

The confidence intervals for the three samples range from fifty-one to forty-two percent of the respective means indicating ratios of 3 to 2½ between highest and lowest accepted means.

However, twelve, sixteen and twenty-three laboratories are apparently capable of producing results within ±20 percent of the accepted values of the respective concentrations for the three samples.

Laboratories 15 and 29 report <0.01 mg/L Cr in Sample C and Laboratories 17 and 30 report <0.02 mg/L for Sample D approximately one-half the mean concentration for these samples.

COBALT

Sample A

Results: 31

Quantitative values: 4

Range: 0.001 to 0.0108 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

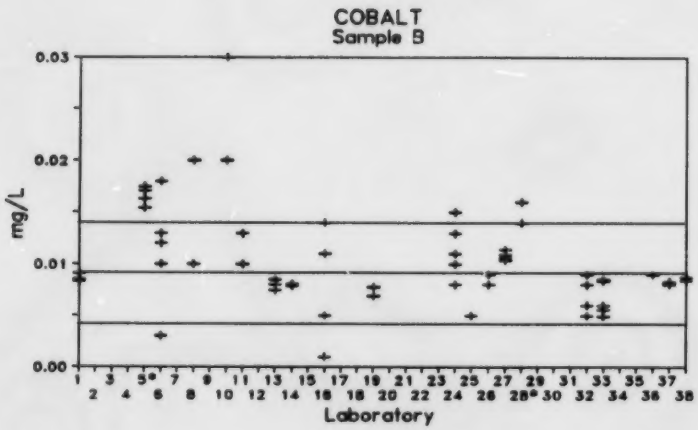
Results: 31

Quantitative values: 17

Range: 0.001 to 0.03 mg/L

t test rejections: 2

Mean: 0.0091 ± 0.0048 mg/L



Sample C

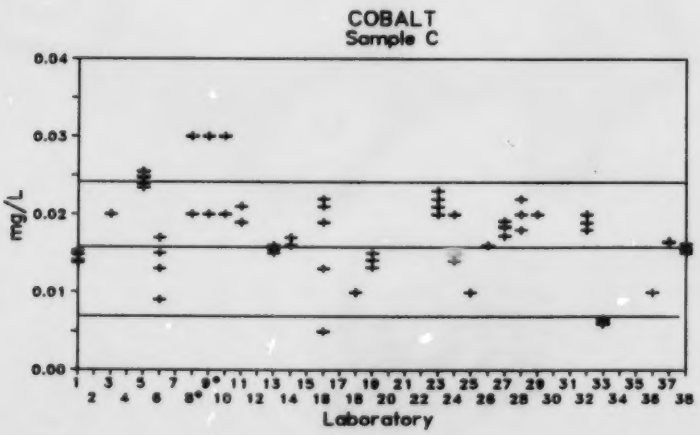
Results: 31

Quantitative values: 21

Range: 0.0059 to 0.03 mg/L

t test rejections: 2

Mean: 0.0159 ± 0.0092 mg/L



Sample D

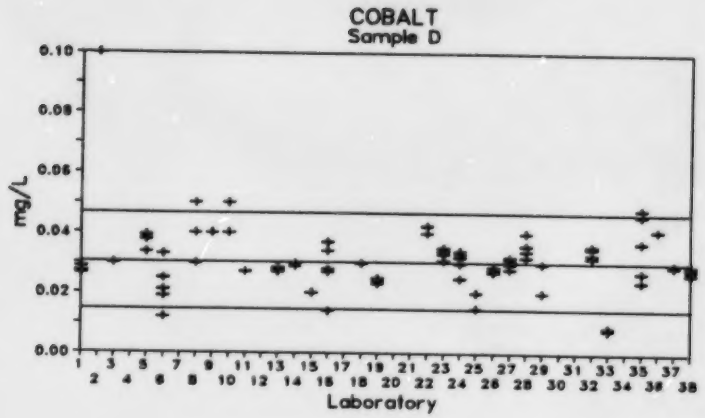
Results: 31

Quantitative values: 25

Range: 0.0008 to 0.1 mg/L

t test rejections: 0

Mean: 0.0307 ± 0.0157 mg/L



Only four (5, 16, 19, 26) of the thirty-four laboratories reported quantitative values for cobalt in Sample A. These ranged between 0.001 and 0.01 mg/L with little consensus, at least twice the NRC results of 0.005 mg/L. There were too few data to warrant plotting the graph.

Seventeen, twenty-one and twenty-five laboratories reported quantitative results respectively for the three samples. While the consensus values for Samples B, C and D are close to the NRC results and target values the confidence limits are 53, 58 and 51 percent of the respective means. This indicates ratios of 3 to 4 between highest and lowest accepted means.

Moreover, only about twelve to fifteen laboratories are apparently capable of producing results within ±20 percent of the accepted values of the respective concentrations of cobalt for the three samples.

All laboratories reported "less than" values above the actual concentrations of Co.

NICKEL

Sample A

Results: 34

Quantitative values: 7

Range: 0.0021 to 0.05 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

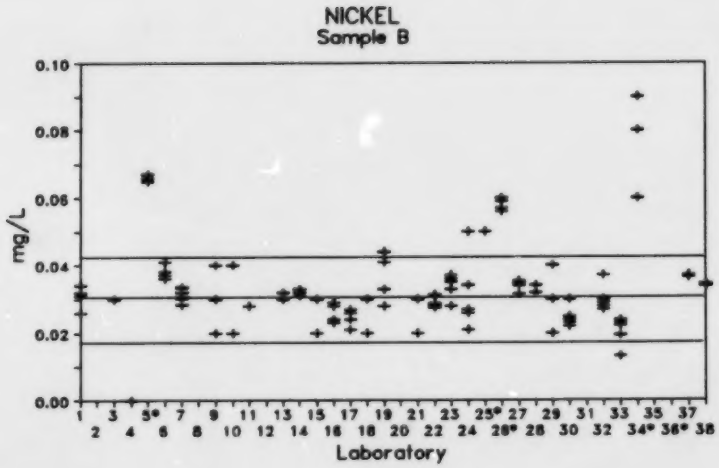
Results: 34

Quantitative values: 27

Range: 0.0133 to 0.09 mg/L

t test rejections: 4

Mean: 0.0302 ± 0.0126 mg/L



Sample C

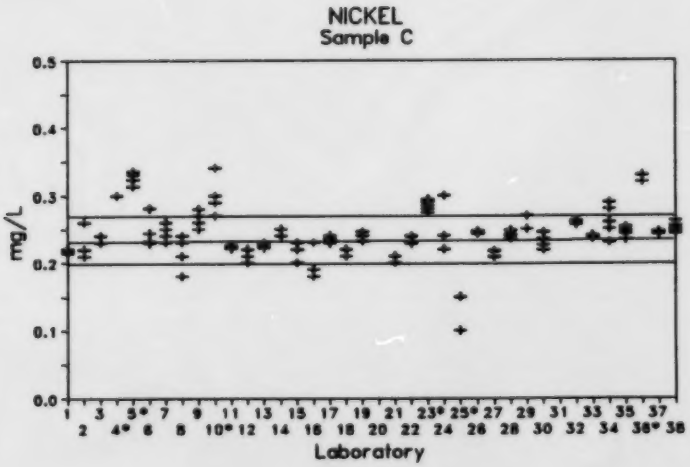
Results: 34

Quantitative values: 34

Range: 0.1 to 0.34 mg/L

t test rejections: 6

Mean: 0.233 ± 0.035 mg/L



Sample D

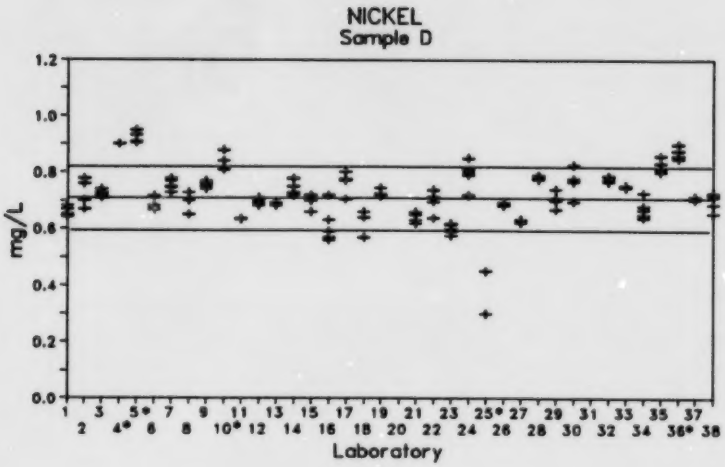
Results: 34

Quantitative values: 34

Range: 0.3 to 0.95 mg/L

***t* test rejections: 5**

Mean: 0.708 ± 0.113 mg/L



Seven of thirty-four laboratories reported quantitative values for sample A with mean values ranging between 0.0026 to 0.049 mg/L. Three of these laboratories (7,14,27) report acceptable concentrations. No graph is shown for sample A.

There is an increase in quantitative results for Sample B with twenty-seven laboratories reporting results. Eighteen of the laboratories produced results within ± 20 percent of the accepted concentration.

For Sample C and D all thirty-four laboratories submitted quantitative results with confidence intervals of fifteen and sixteen percent of the respective means. Thirty of these results for nickel are within ± 20 percent of the accepted value in Sample C and D.

Laboratory 5 and 36 are biased high for Samples B,C and D. Laboratory 25 is low for Sample C and D but high for B. Results submitted by laboratories 5, 25 and 36 were statistically rejected from the mean calculations for all three samples.

The overall quality of nickel results were quite good and second only to zinc.

COPPER

Sample A

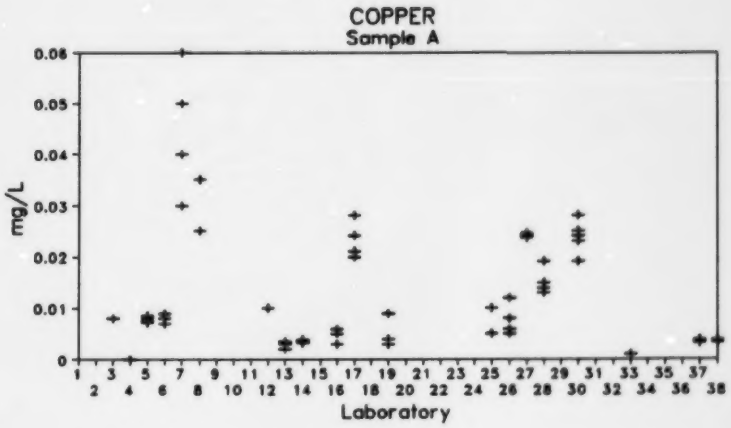
Results: 34

Quantitative values: 13

Range: 0.002 to 0.06 mg/L

t test rejections: -

Mean: not calculated



Sample B

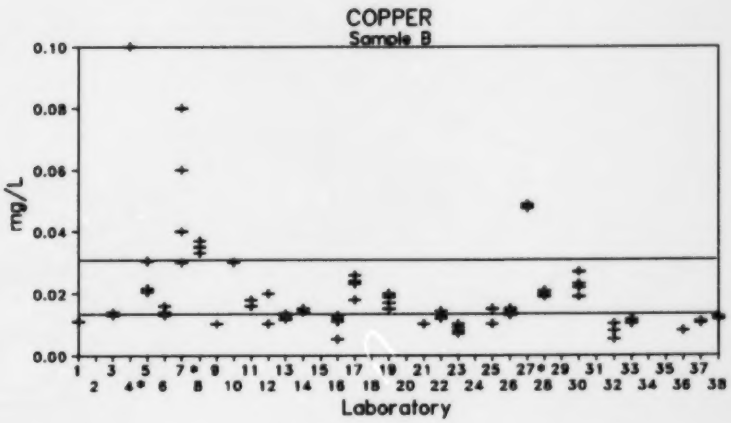
Results: 34

Quantitative values: 26

Range: 0.005 to 0.1 mg/L

t test rejections: 3

Mean: 0.0146 ± 0.0161 mg/L



Sample C

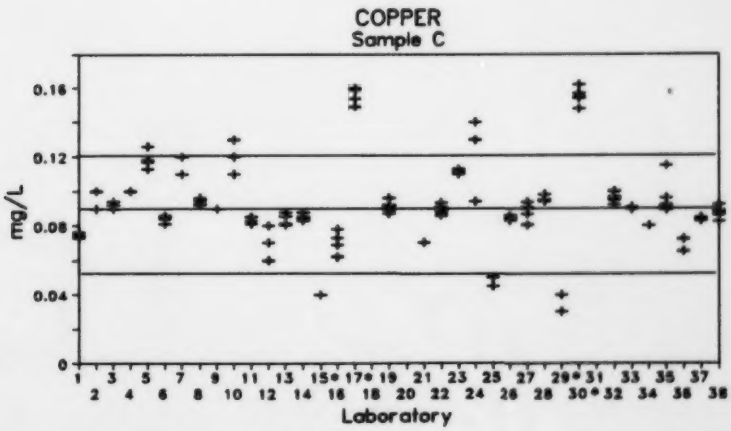
Results: 34

Quantitative values: 33

Range: 0.03 to 0.16 mg/L

t test rejections: 4

Mean: 0.0892 ± 0.0328 mg/L



Sample D

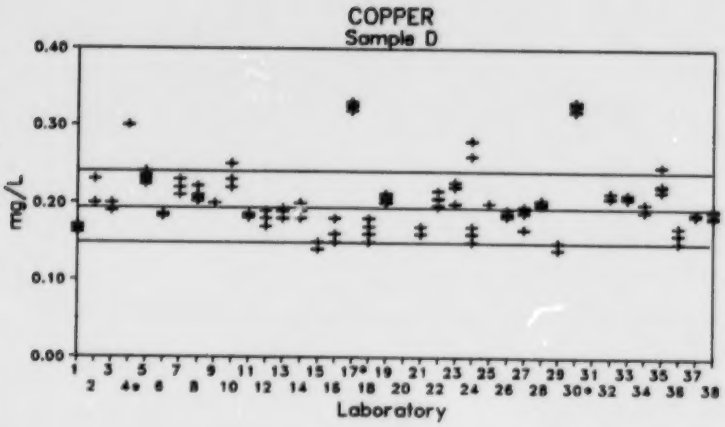
Results: 34

Quantitative values: 34

Range: 0.14 to 0.326 mg/L

t test rejections: 3

Mean: 0.196 ± 0.046 mg/L



All thirty-four laboratories submitted copper results for the four samples.

For Sample A thirteen laboratories reported quantitative results with mean values ranging between 0.0028 to 0.042 mg/L, however, only four laboratories (13,14,25,26) were judged acceptable. There was insufficient data to calculate a reliable mean and confidence interval for Sample A.

Twenty six laboratories submitted quantitative results for Sample B ranging between 0.007 and 0.1 mg/L. The confidence level is more than 100 percent of the mean which is an unacceptable situation. Thirteen laboratories reported results within ±20 percent of the accepted values.

Thirty-three of thirty four laboratories reported quantitative results for Samples C and D with confidence intervals of thirty-seven and twenty-four percent, respectively.

Laboratories 17 and 30 report values with good precision but high biases for Samples C and D, perhaps a mathematical error. Laboratories 15 and 29 are biased a little low for Samples C and D.

Laboratory 18 reported <0.01 for Sample C when the actual concentration is 0.089 mg/L.

ZINC

Sample A

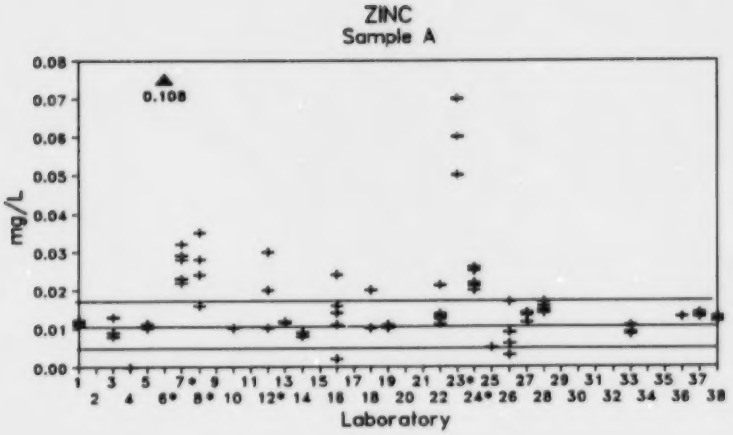
Results: 34

Quantitative values: 20

Range: 0.003 to 0.109 mg/L

t test rejections: 6

Mean: 0.0111 ± 0.0057 mg/L



Sample B

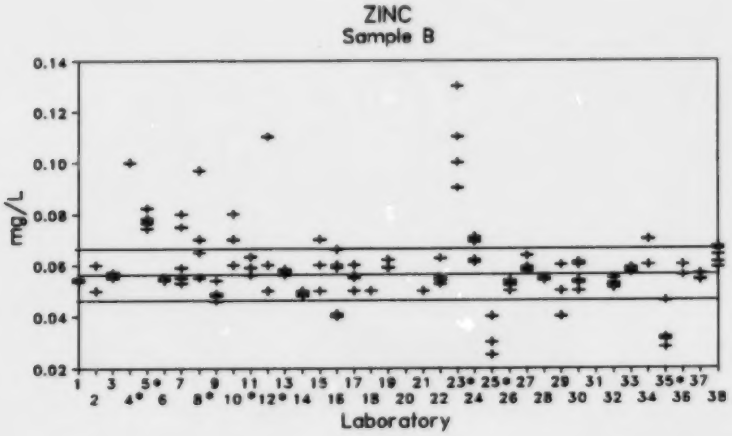
Results: 34

Quantitative values: 33

Range: 0.025 to 0.13 mg/L

t test rejections: 8

Mean: 0.0557 ± 0.0098 mg/L



Sample C

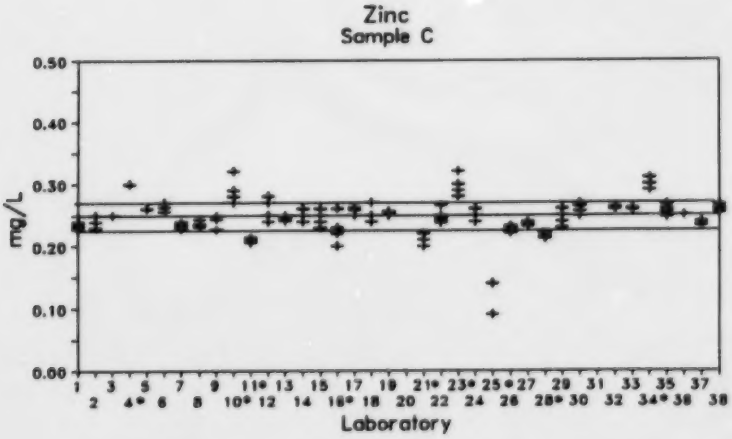
Results: 34

Quantitative values: 34

Range: 0.090 to 0.32 mg/L

t test rejections: 9

Mean: 0.249 ± 0.022 mg/L



Sample D

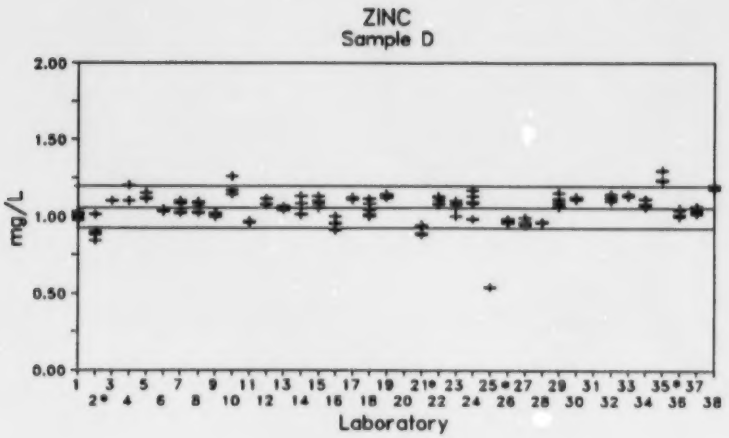
Results: 34

Quantitative values: 34

Range: 0.54 to 1.3 mg/L

***t* test rejections: 4**

Mean: 1.06 ± 0.14 mg/L



All thirty-four laboratories submitted results for zinc and the overall results are better than for any of the other elements in this exercise. For Sample A, twenty of thirty-four laboratories reported quantitative results with means ranging between 0.005 and 0.108 mg/L. Exactly half of these results were within ±20 percent of the accepted mean. This is the only element where a mean and confidence interval were calculated for Sample A.

For Sample B all but one laboratory reported quantitative results. Mean values ranged between 0.03 and 0.11 mg/L and the confidence interval after eight *t* test rejections was only eighteen percent of the final calculated mean.

Quantitative results were received from all thirty-four laboratories for Samples C and D. Confidence intervals were nine and thirteen percent, respectively, for these two samples, quite good compared to results for other elements.

Laboratory 25 is biased low by an approximate factor of two for all samples, perhaps a mathematical error. Laboratories 4, 10 and 23 are biased high for Samples B and C.

Laboratories 9 and 35 report <0.005 mg/L for Sample A approximately one-half the average mean of 0.011 mg/L.

MOLYBDENUM

Sample A

Results: 28

Quantitative values: 5

Range: 0.0029 to 0.03 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

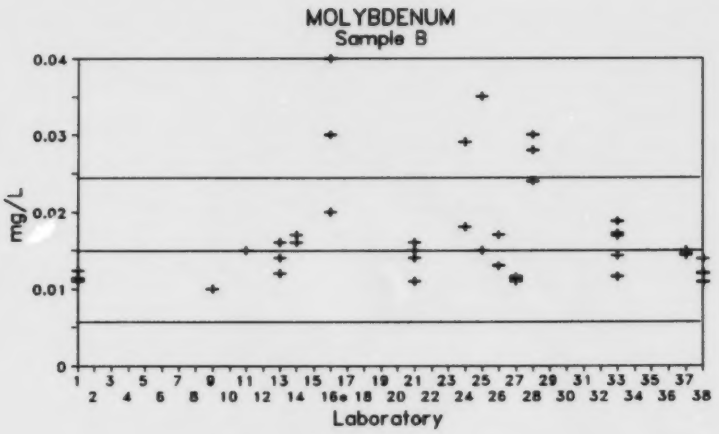
Results: 28

Quantitative values: 11

Range: 0.011 to 0.04 mg/L

t test rejections: 1

Mean: 0.0151 ± 0.0095 mg/L



Sample C

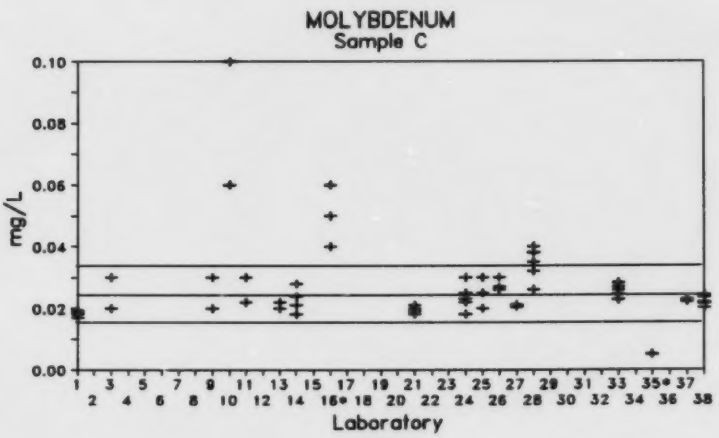
Results: 28

Quantitative values: 15

Range: 0.005 to 0.1 mg/L

t test rejections: 2

Mean: 0.0247 ± 0.0091 mg/L



Sample D

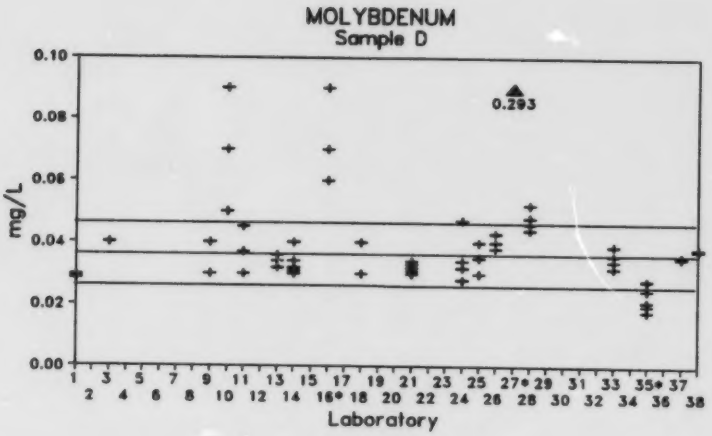
Results: 28

Quantitative values: 16

Range: 0.018 to 0.296 mg/L

t test rejections: 3

Mean: 0.0362 ± 0.0100 mg/L



Five of twenty-eight laboratories reported quantitative results for molybdenum in Sample A, three of these (1,14,26) were judged acceptable. Due to insufficient data the mean and confidence interval were not calculated and no graph is shown.

Six of the eleven laboratories that submitted quantitative results for Sample B reported values within ± 20 percent of the accepted concentration. The confidence interval for Sample B is sixty-three percent of the mean which represents a ratio of 4.5 between the lowest and highest acceptable means.

Fifteen and sixteen laboratories reported quantitative values for molybdenum in Sample C and D, respectively, with confidence intervals of thirty-seven and twenty-eight percent. Eleven values for Sample C and twelve values for Sample D were within ±20 percent of the accepted concentration.

Laboratory 35 is biased low for Sample C and D, while laboratories 16 and 28 are biased high for the same samples.

Laboratory 15 and 29 report <0.01 mg/L for Sample D and Laboratory 16 reports <0.016 when the accepted concentration is 0.036 mg/L.

SILVER

Sample A

Results: 29
Quantitative values: 2
Range: 0.019 to 0.007 mg/L
‡ test rejections: -
Mean: not calculated

No graph for sample A

Sample B

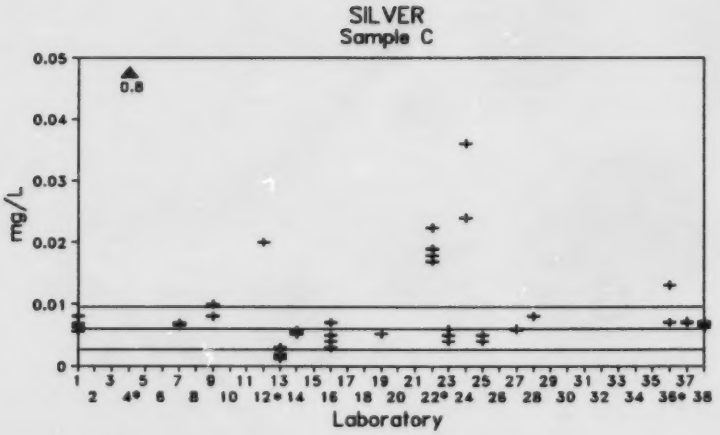
Results: 29
Quantitative values: 5
Range: 0.0013 to 0.01 mg/L
‡ test rejections: -
Mean: not calculated

No graph for sample B

Sample C

Results: 29
Quantitative values: 15
Range: 0.004 to 0.8 mg/L

‡ test rejections: 4
Mean:0.00599 ± 0.00376 mg/L



Sample D

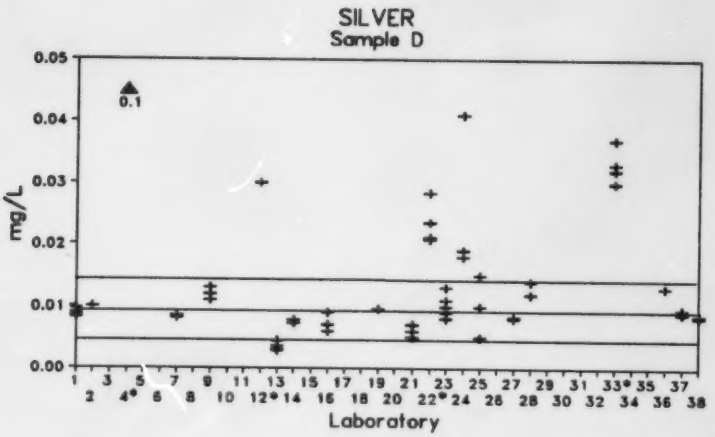
Results: 29

Quantitative values: 17

Range: 0.0028 to 0.1 mg/L

***t* test rejections: 4**

Mean: 0.00927 ± 0.00513 mg/L



Only two labs reported quantitative data for sample A and both were orders of magnitude above the NRC analysis. These same two labs did not report quantitative values for sample B.

Five of twenty-nine laboratories reported quantitative results for sample B ranging between 0.002 and 0.01 mg/L. Laboratories (7,16,23) were within ±20 percent of the accepted value. For both Samples A and B there was insufficient data to calculate a mean and confidence interval and no graph is shown.

For Sample C, fifteen of twenty-nine laboratories reported quantitative values with means ranging between 0.005 and 0.8 mg/L. Eight of the laboratories (1,7,14,16,19,23,25,27) were able to determine silver at concentrations within ±20 percent of the accepted value.

Nine of seventeen laboratories that reported quantitative values for Sample D were within ±20 percent of the accepted concentration. For Samples C and D the confidence interval was sixty-three and fifty-five percent of the respective means. This correspond to a ratio of approximately four between the highest and lowest acceptable concentration for both samples.

Laboratory 4 has serious problems determining silver in Sample C and D. Laboratories 12 and 22 are biased high for samples C and D while laboratory 13 is biased slightly low for the same samples.

Laboratory 35 reports <0.005 mg/L for Sample D approximately one-half the actual concentration.

CADMIUM

Sample A

Results: 34

Quantitative values: 7

Range: 0.0002 to 0.004 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

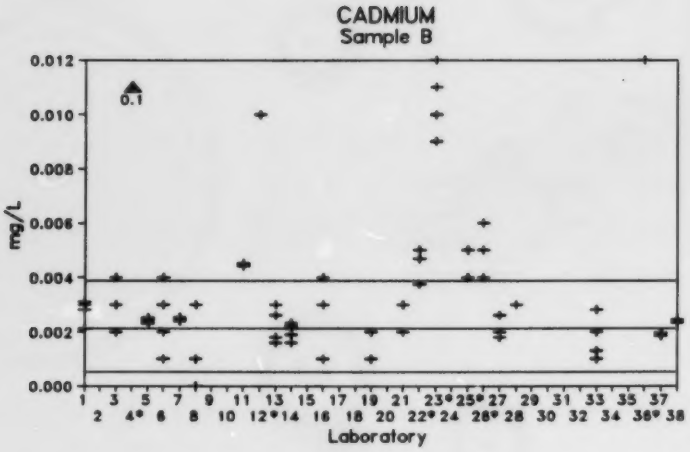
Results: 34

Quantitative values: 22

Range: 0.001 to 0.1 mg/L

t test rejections: 7

Mean:0.00226 ± 0.00164 mg/L



Sample C

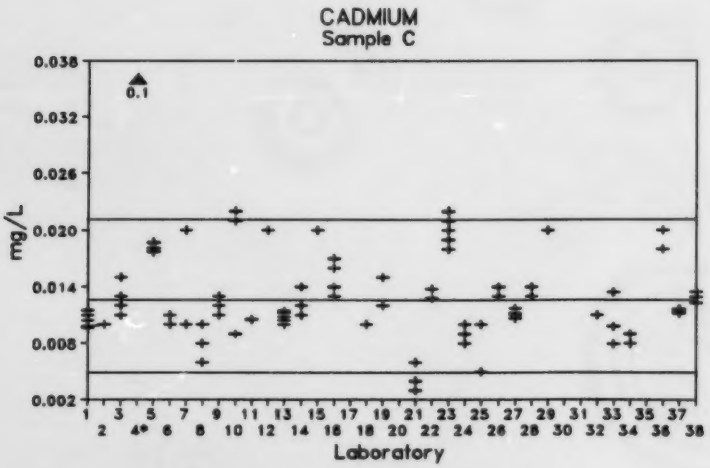
Results: 34

Quantitative values: 29

Range: 0.0073 to 0.1 mg/L

t test rejections: 1

Mean: 0.0129 ± 0.0082 mg/L



Sample D

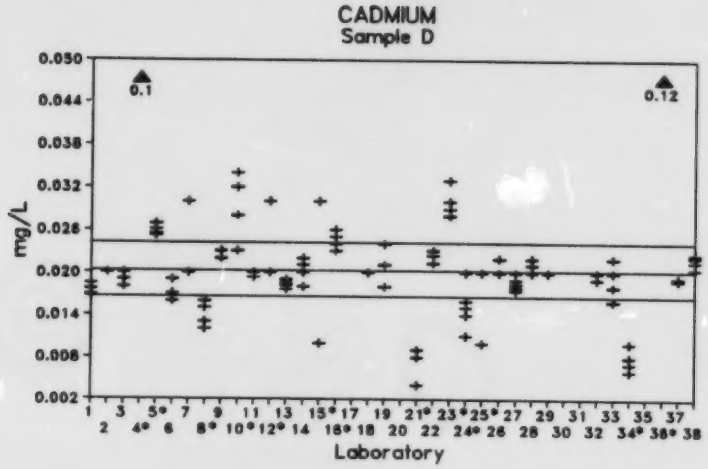
Results: 34

Quantitative values: 31

Range: 0.006 to 0.13 mg/L

t test rejections: 13

Mean: 0.0201 ± 0.0035 mg/L



Seven of thirty-four laboratories reported quantitative values for sample A ranging between 0.0002 and 0.003 mg/L. All of these values are orders of magnitude larger than the NRC value of 0.00003 mg/L. There was insufficient data for Sample A to calculate a mean or to draw a graph.

A greater number of laboratories reported quantitative data for Sample B. Twenty-two of thirty-four laboratories reported quantitative values ranging between 0.001 and 0.1 mg/L, The calculated confidence interval is quite high at seventy-three percent of the mean, this represents a factor of six between the lowest and highest acceptable mean. Only ten laboratories (1,5,6,7,13,14,16,21,27,33) are within ±20 percent of the accepted concentration.

Thirty-one laboratories reported quantitative data for cadmium in Sample D, eighteen of which were within ±20 percent of the consensus value.

Laboratory 4 is biased quite high for Sample B,C and D. Laboratory 36 has a problem with Sample B and D yet Sample C was within the confidence interval. Laboratory 23 is biased high for Sample C and D whereas laboratory 21 is biased low for the same samples.

Laboratory 17 and 30 report Cd in Sample D at <0.01 mg/L and Laboratory 35 reports <0.002 mg/L for the same sample when the actual concentration is 0.02 mg/L.

THALLIUM

Sample A

Results: 22

Quantitative values: 1

Range: 0.03 to 0.05 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

Results: 22

Quantitative values: 1

Range: 0.04 to 0.05 mg/L

t test rejections: -

Mean: not calculated

No graph for sample B

Sample C

Results: 22

Quantitative values: 5

Range: 0.002 to 0.034 mg/L

t test rejections: -

Mean: not calculated

No graph for sample C

Sample D

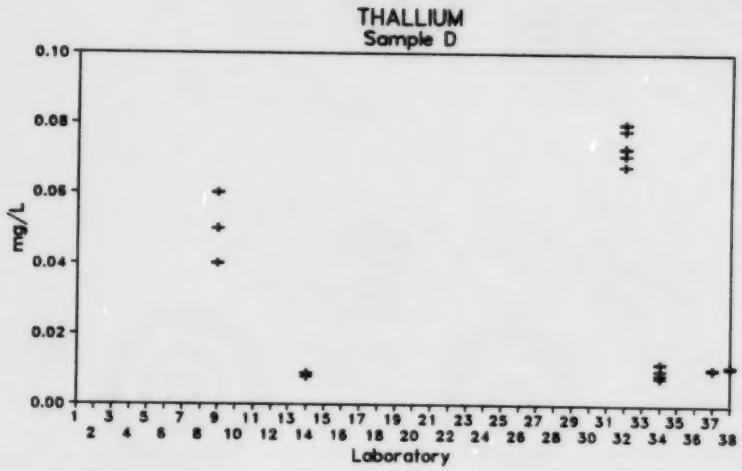
Results: 22

Quantitative values: 5

Range: 0.008 to 0.06 mg/L

***t* test rejections: -**

Mean: not calculated



The poorest participant response was received for thallium with twenty-two of thirty-four laboratories submitting results.

Only one laboratory reported quantitative values for sample A and B. This was expected as the NRC ICP-MS value of 0.000005 mg/L for sample A is below the detection capability of most other analytical techniques. Thallium at 0.001 mg/L was too low to be detected by any laboratory in this exercise.

Only one (laboratory 14) of the five laboratories reporting quantitative values for Sample C could be considered acceptable. Results ranged between 0.002 to 0.05 mg/L.

Due to insufficient data no mean or confidence interval was calculated for Samples A, B or C and no graphs are shown.

Four laboratories reported quantitative results for Sample D, two values (laboratories 14 and 34) are judged acceptable. A graph was plotted for Sample D but a mean and confidence interval were not calculated. If the MDL were set at 0.01 mg/L, only two of these laboratories could detect thallium at concentrations slightly above this level.

Laboratory 9 found the same concentration of Tl in all four samples.

LEAD

Sample A

Results: 34

Quantitative values: 3

Range: 0.002 to 0.030 mg/L

t test rejections: -

Mean: not calculated

No graph for sample A

Sample B

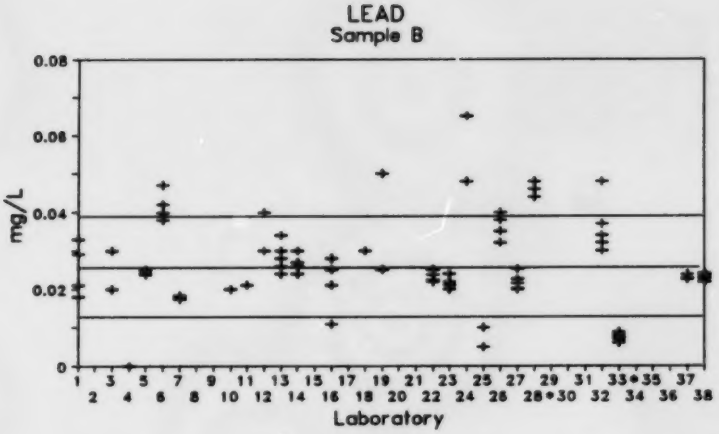
Results: 34

Quantitative values: 18

Range: 0.006 to 0.065 mg/L

t test rejections: 2

Mean: 0.0264 ± 0.0129 mg/L



Sample C

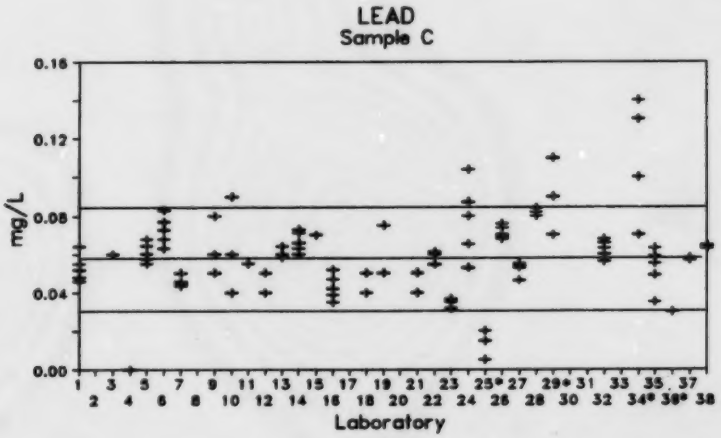
Results: 34

Quantitative values: 27

Range: 0.005 to 0.14 mg/L

t test rejections: 4

Mean: 0.0588 ± 0.0239 mg/L



Sample D

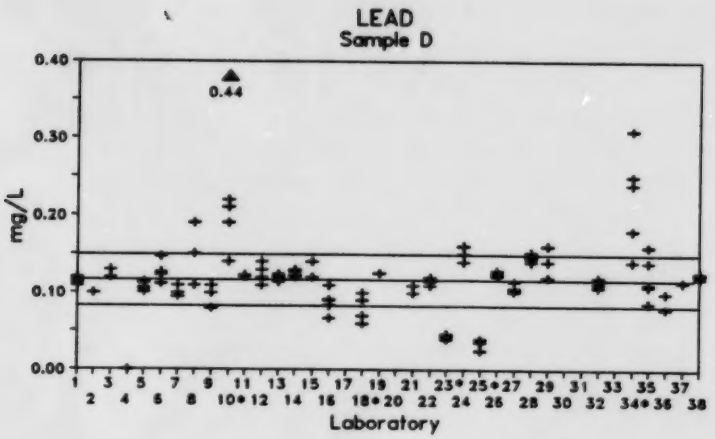
Results: 34

Quantitative values: 28

Range: 0.035 to 0.44 mg/L

***t* test rejections: 5**

Mean: 0.118 ± 0.032 mg/L



Thirty-four laboratories reported Pb results for all samples.

Three laboratories (6,23,26) reported quantitative results between 0.002 and 0.03 mg/L for Pb in Sample A, none of which were near the NRC analysis of 0.0002 mg/L.

Eighteen laboratories reported quantitative values for Pb in Sample B with means ranging between 0.0075 to 0.046 mg/L. The calculated confidence interval is 49 percent of the mean, this corresponds to a factor of three between the highest and lowest acceptable concentration for this sample. Thirteen laboratories (1,3,5,7,11,12,13,14,16,19,22,23,27) could determine Pb within ±20 percent of the accepted value of 0.026 mg/L.

Twenty-seven and twenty-eight quantitative results were reported for Sample C and D, respectively, with final confidence intervals of forty-one and twenty-seven percent. Only sixteen laboratories could determine Pb within ±20 percent of the mean for sample C and twenty laboratories were within the same interval for Sample D.

Laboratory 25 reports low results for Samples B,C and D, whereas, laboratory 34 is biased high for Sample C and D.

Laboratory 17 and 30 reports <0.05 mg/L Pb in Sample D and Laboratory 33 reports <0.03 mg/L when the actual concentration is 0.118 mg/L.

3. DISCUSSION

3.1. Accuracy and Precision

The intent of this study was to assess the capability of the participating laboratories and this is best done through an evaluation of their accuracy and precision. In all cases where sufficient data were reported to calculate a reliable mean, they were close to the NRC values and to the target values. Therefore, these calculated means and the confidence intervals could be used as benchmarks in assessing accuracy. This implies that the accuracy evaluation of a laboratory is relative to the performance of all accepted laboratories for a particular analyte in a particular sample.

A system to evaluate laboratory performance for individual elements was established and is shown in Appendix C. An overall assessment based on these results allowed four distinct categories of performance to be discernible as shown in Table II. Superior laboratories submitted results for almost all elements consistently within the 95% confidence interval or reported very reasonable "less than" values. Good laboratories submitted results for most elements with a minimum number of outliers while fair laboratories had some problems with some elements or did not submit results for a number of elements. Laboratories with a high proportion of outliers were categorized in the final group. Except for zinc, the results for Sample A were not considered in this evaluation. The results for Be and Tl in all samples were also not included.

The relative standard deviation (RSD) was used to evaluate intralaboratory precision.

TABLE II
Accuracy and Precision Evaluation

	Accuracy	Precision
Superior	1,3,13,14,27	1,5,17,19,26,27, 28,30,32
Good	7,9,11,19,22, 26,28,32	3,13,14,21,22, 23
Fair	2,5,6,8,12,15,16, 18,21,23,24,25, 29,33,35,36	2,4,6,7,9,11,12, 15,18,25,29,33, 35,36
Problems	4,10,17,30,34	8,10,16,24,34

The proportion of results with a RSD within ±10% for samples C and D and within ±20% for sample B also enabled the four categories of performance in Table II to be established.

Laboratory accuracy is considered to be of much greater significance than intralaboratory precision with the consideration, of course, that good accuracy implies acceptable precision. Table II demonstrates that all five "superior accuracy" laboratories attained superior or good precision and that five of the eight "good accuracy" laboratories did equally well precision wise. However, achieving superior precision (5, 17, 30) is obviously no guarantee of good accuracy.

There is also an apparent correlation between poor performance and getting results in at the last minute (25, 29, 33, 34, 35, 36). Laboratory numbers were assigned in order of receipt. This does not bode well for these laboratories if they often work towards tight deadlines. Laboratories 20 and 31 submitted only duplicate results. These were not evaluated.

The exact similarity of results from laboratories 17 and 30 is very disturbing. For all elements only the final significant figure differed between these two sets of results. Also, the close correspondence of results for some elements between laboratories 15 and 29 is beyond statistical expectations.

TABLE III
Comparison of Average Repeatability between Superior Laboratories and all Laboratories, mg/L

Element	Concentration	Average Repeatability	
		Overall	Superior
Al	0.127	0.021	0.009
V	0.0289	0.0029	0.0007
Cr	0.0186	0.0048	0.0008
Co	0.0307	0.0037	0.002
Ni	0.0302	0.0042	0.0010
Cu	0.0146	0.0028	0.0006
Zn	0.0111	0.0027	0.0007
Mo	0.0362	0.0034	0.0013
Cd	0.00226	0.00089	0.00039
Pb	0.0588	0.0094	0.0033

Table III compares the average repeatability between the superior rated laboratories and the overall repeatability from all results. The samples chosen for this comparison had concentrations at or slightly above the recommended MISA method detection limit. The comparison shows the "superior" laboratories with repeatabilities two to five times better than the overall average standard deviation.

3.2. Analytical Techniques

Table IV lists information from the participants concerning the analytical techniques used for the determinations performed in this report. Eighteen laboratories used flame atomic absorption spectrometry (FAAS), sixteen used inductively coupled plasma emission spectrometry

TABLE IV
Analytical Techniques

Lab	Instrument	Previous Analysis of STP Effluent	Digestion	Preconc-entration	Analysis on Different Days	No Experience with Elements
1	ICP	No	Yes	Yes	No	-
2	FAAS	Yes	No	No	Yes	Ag
3	ICP	Yes	-	-	-	-
4	FAAS	No	Yes	-	Yes	Ag,Al,Cr, Ni,Pb
5	GF & FAAS	No	No	No	No	-
6	FAAS	Yes	Yes	-	No	-
7	GF & FAAS	Yes	Yes	Yes	Yes	-
8	FAAS	No	Yes	No	No	Ag,Be,Co Mo,Tl,V
9	ICP & FAAS	Yes	Yes	No	No	-
10	ICP	Yes	Yes	No	No	-
11	FAAS	No	Yes	No	No	Al,Mo,V
12	FAAS	Yes	Yes	Yes	No	Ag,Al,Co,Mo

Lab	Instrument	Previous Analysis of STP Effluent	Digestion	Preconc-entration	Analysis on Different Days	No Experience with Elements
13	ICP & GFAAS	Yes	Yes	Yes	No	-
14	ICP & GFAAS	Yes	No	No	No	-
15	ICP	No	No	No	Yes	-
16	FAAS	Yes	Yes	No	Yes	-
17	ICP	No	No	No	Yes	-
18	ICP	No	Yes	No	No	-
19	FAAS	No	Yes	Yes	Yes	Co, Cr
20	FAAS	Yes	Yes	Yes	Yes	-
21	ICP	No	Yes	Yes	No	-
22	FAAS	Yes	Yes	Yes	No	Be,Mo,Tl,V
23	FAAS	-	Yes	Yes	No	Be, Tl
24	ICP	No	Yes	No	Yes	Tl
25	GFAAS	No	Yes	Yes	Yes	Be,Tl,V
26	ICP	No	Yes	No	No	-
27	ICP	-	Yes	Yes	Yes	-
28	FAAS	Yes	No	No	Yes	Be,Mo,Tl
29	ICP	No	No	No	Yes	-
30	-	No	No	No	Yes	-
31	FAAS	Yes	Yes	Yes	Yes	-
32	ICP	Yes	No	No	No	-
33	ICP	No	-	Yes	No	-
34	FAAS	Yes	No	No	No	-
35	-	Yes	Yes	Yes	Yes	-
36	FAAS	Yes	Yes	Yes	No	Be,Mo,V
37	ICP-MS	No	Yes	Yes	No	-
38	GFAAS & ICP	No	Yes	Yes	No	-

(ICP) and five used graphite furnace atomic absorption spectrometry (GFAAS) for all or a portion of the analyses. Unfortunately, many laboratories which used two measuring techniques did not tell us which was used for which metal on which sample. This made it impossible to make any definitive statement regarding the efficacy of any. All the "superior accuracy" laboratories used either ICP, GFAAS or both. However, four of the eight "good" laboratories used only FAAS with acceptable performances. It would appear that the laboratory practice is more important than the choice of instrumentation. But it appears to be more difficult to obtain reliable values with FAAS.

It is apparently advantageous to use ICP rather than FAAS to determine vanadium, or either ICP or GFAAS rather than FAAS for molybdenum.

Exactly half of the laboratories reported previous experience in analyzing STP effluents including three of the five laboratories rated superior. The significance of this is questionable since two of five laboratories rated as having problems also reported previous experience analysing STP effluents. Two-thirds of the participants digested the samples prior to analysis and fifteen laboratories preconcentrated samples before analysis. However, no correlation between good results and sample digestion or preconcentration could be discerned. Although no instructions were given, sixteen participants analysed the samples on different days. It is interesting to note that of the seven laboratories rated "superior" for precision, five performed the analyses on different days. Table IV also lists the elements for which the laboratories reported having no experience. Beryllium and thallium were most commonly listed (6), followed by molybdenum and vanadium (5) and silver (4). There were very few results for beryllium and thallium.

Six municipal laboratories participated in this intercomparison. One was categorized as good, one with problems and the remaining four as fair for laboratory accuracy. A similar distribution occurred for the precision evaluation. It should be noted that all of the "superior" and all but one of the laboratories rated "good" were private sector laboratories. Four municipal laboratories used FAAS, and two used FAAS with some GFAAS determinations.

The majority of laboratories reported two or three significant figures. Seven laboratories reported four significant figures for Al and Zn which is obviously unjustified. The number of significant figures reported should be related to the achieved standard deviation. Too many are unjustified. Too few leads to a loss of information. This aspect was not considered in this evaluation. Indeed, one of the "superior" laboratories reported only one significant figure for some determinations.

A laboratory was given an insensitive rating "I" when the less than value was greater than two times the upper confidence limit. This was an arbitrary choice, but considering concentrations in sample B and C are at or near the MDL it is reasonable to expect detection limits in this concentration range.

3.3 Detection Limits

Participants were asked to list their limit of detection for each element and their method used for calculating it. A OME-MISA document *Estimation of Analytical Method Detection Limits (MDL)*, Protocol ISBN 0 - 7729-4117-3, describes the procedure to determine MDL, which is the minimum concentration of an element in laboratory grade water that can be determined with an appropriate confidence. Approximately half of the laboratories reported an MDL using this procedure and these MDLs are compared in Table V to the suggested MISA method detection limit.

TABLE V
Method Detection Limit

Element	Suggested Minimum Concentration mg/L	MDL's Reported	MDL's at or below Suggested Minimum Concentration
Be	0.01	15	13
Al	0.03	16	14
V	0.03	16	13
Cr	0.02	18	17
Co	0.02	18	17
Ni	0.02	18	17
Cu	0.01	18	16
Zn	0.01	18	17
Mo	0.02	16	12
Ag	0.03	15	14
Cd	0.002	18	14
Tl	0.03	14	9
Pb	0.03	18	13

A majority of the laboratories reporting MDLs were able to attain the necessary suggested minimum concentrations. The exceptions were for Mo, Cd, Tl and Pb where one-quarter of the MDL reporting laboratories could not achieve the required MDL.

Other methods were reported for determining detection limits, they are listed below with the frequency of appearance listed in brackets:

- 2σ blank noise (7)
- 3σ blank noise (4)
- taken from operation manual (2)
- estimation from analysis of standards (1)
- lowest standard in calibration (1)

4. CONCLUSIONS

It is evident from this exercise that most laboratories cannot accurately determine the listed trace elements relative to this study at concentration levels in a filtered STP effluent (Sample A). However, if it is only necessary that laboratories be able to determine concentrations above a minimum level to be set by OME the results are much more encouraging with over one-third of the participants in the "superior" and "good" categories.

Insufficient data were received for beryllium and thallium to perform any meaningful evaluation for these elements. If these elements and silver are to be on the list there will be problems in many laboratories to achieve reliable results. The spread of results for cadmium and lead in Samples B and C also indicates potential problems for the determination of these two environmentally important metals.

The majority of laboratories that reported method detection limits were able to achieve the proposed MISA MDL's. Detectibility should not be a problem if the minimum suggested concentrations are adopted with the exception of the three elements listed above.

The type of instrumentation used by participants was almost equally divided between FAAS and ICP with relatively few analyses performed using the more sensitive GFAAS. This probably accounts for some of the sensitivity problems with Samples B and C.

When results are inaccurate, they are more often high than low, generally indicating contamination or blank problems.

There are several probable arithmetic errors. These are due to problems in simple arithmetic or forgetting a dilution factor.

Private sector laboratories generally appeared to perform much better than municipal laboratories in this study.

A suitable certified reference material would be of great help to assure reliability at concentrations similar to those in Samples B and C.

5. ACKNOWLEDGEMENTS

The authors would like to thank Jean-Marc LaFrance and Sue Sams of the R.D. Pickard Water Treatment Plant for their advice and cooperation during the collection of the STP sample, Joe Lam and Jim McLaren of the Environmental Measurement Science Program of NRC's Institute for Environmental Chemistry for supplying inductively coupled plasma mass spectrometry and isotope dilution inductively coupled plasma mass spectrometry results and Victor Boyko of the same Institute for the ICP results.

Appendix A

Data was received from the following laboratories:

A & L Canada Laboratories East, Inc.
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Brampton,Ontario
L6T 4S8
Dr. Ravi Kanipayor

Accurassay Laboratories Ltd.
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Kirkland Lake,Ontario
PSN 3J1
Mr. Darrin Labine

Accutest Laboratories Ltd.
146 Colonade Road, Unit 8
Nepean,Ontario
K2E 7Y3
Mr. Peter Haulena

Alpha Laboratories Inc.
285 Lesmill Road
Don Mills,Ontario
M3B 2V1
Mr. Joel Villanueva

Animol Laboratories
83 Citation Dr., Unit 9
Concord,Ontario
L4K 2S4
Dr. George M. Tamari

ARECO Canada Inc.
28 Concourse Gate
Nepean,Ontario
K2E 7T7
Mr. Andy Rybak

Barringer Laboratories Ltd.
5735 McAdam Road
Mississauga,Ontario
L4Z 1N9
Mr. Todd Henry

Beak Analytical Services
14 Abacus Road
Brampton,Ontario
L6T 5B7
Mr. Chester Lastoria

Bondar-Clegg & Co Ltd
5420 Canotek Rd.
Gloucester,Ontario
KIJ 9G2
Mr. Mike Ziebell

Canviro Analytical Laboratories Ltd.
50 Bathurst Drive, Unit 12
Waterloo,Ontario
N2V 2C5
Mr. Jeffrey Pike

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29 Waterworks Place
Guelph,Ontario
N1E 6P7
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Mr. David McKiver

Dillon Environmental Laboratories
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Mississauga,Ontario
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Mr. James B. King

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Dresden,Ontario
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EAG Analytical Services
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Markham,Ontario
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Dr. Suman Punani

Enviroclean
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Metro Toronto Department of Works
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Technical Services Laboratories
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Mississauga,Ontario
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Thunder Bay Analytical Laboratories Inc.
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Mr. Aldo D. Martinuzzi

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L2V 3Y8
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XRAL Environmental
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Data was not received from the following laboratories:

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Elliot Lake,Ontario
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Mr. Rob deBertoli

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Ministry of Environment
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Ms. Cindy Spencer

Municipality of Metropolitan Toronto
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Mr. A. Dobson

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Mr. Richard Laughton

Polytechnic Laboratories Ltd
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Mississauga,Ontario
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Mr. Stanley M. Cowan

Queen's University
99 University Avenue
Kingston,Ontario
K7L 3N6
Dr. John Poland

Regional Lab of Hamilton-Wentworth
700 Woodward Avenue
Hamilton,Ontario
L8H 6P4
Ms. Judith Szekely

Appendix B

Beryllium

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	-	-
Lab	2							
Lab	3	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	9	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12							
Lab	13	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-
Lab	14	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16							
Lab	17	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.002						
Lab	21	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	24	<0.003	<0.003	<0.003	<0.003	<0.003	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-
Lab	28	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	31							
Lab	32							
Lab	33	0.0007	<0.0005	0.0006	<0.0005	<0.0005	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-
Lab	38	0.000002	0.000004	0.000002	0.000002	0.000006	0.000003	0.000002

Beryllium

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	-	-
Lab	2							
Lab	3	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	9	0.001	0.001	0.001	<0.001	<0.001	-	-
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12							
Lab	13	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
Lab	14	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16							
Lab	17	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.002						
Lab	21	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	24	<0.003	<0.003	<0.003	<0.003	<0.003	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000
Lab	28	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	31							
Lab	32							
Lab	33	0.00023	0.0003	0.0002	0.0003	0.0005*	0.0003	0.0001
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-
Lab	38	0.000057	0.000071	0.000051	0.000054	0.000064	0.000059	0.000008

Beryllium

Sample C

mg/L

							Mean	Standard Deviation
Lab	1	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	-	-
Lab	2							
Lab	3	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	9	0.001	0.001	0.001	0.001	0.001	0.001	0.000
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12							
Lab	13	0.0005	0.0005	0.0006	0.0005	0.0006	0.0005	0.0001
Lab	14	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0000
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16							
Lab	17	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.002						
Lab	21	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	-	-
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	24	<0.003	<0.003	<0.003	<0.003	<0.003	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	0.00040	0.00070	0.00050	0.00060	0.00060	0.00056	0.00011
Lab	28	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	31							
Lab	32							
Lab	33	0.0006	0.0009	0.0007	0.0007	0.0008	0.0007	0.0001
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.000478	0.000458	0.000487	0.000397	0.000421	0.000458	0.000028
Lab	38	0.00046	0.00048	0.00046	0.00046	0.00048	0.00045	0.00001

Beryllium

Sample D
mg/L

							Mean	Standard Deviation
Lab	1	0.0008	0.0009	0.0011	0.0008	0.0009	0.0009	0.0001
Lab	2							
Lab	3	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	9	0.001	0.001	0.002	0.002	0.001	0.001	0.001
Lab	10	<0.01	0.01	<0.01	0.01	0.01	-	-
Lab	11							
Lab	12							
Lab	13	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0000
Lab	14	0.0018	0.0018	0.0018	0.0019	0.0019	0.0018	0.0001
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16							
Lab	17	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.002						
Lab	21	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0000
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	24	<0.003	<0.002	<0.002	<0.003	<0.003	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	0.00125	0.00140	0.00135	0.00130	0.00132	0.00132	0.00006
Lab	28	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	31							
Lab	32							
Lab	33	0.0012	0.0010	0.0009	0.0012	0.0007	0.0010	0.0002
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.000950	0.000950	0.000965	0.000806	0.001030	0.000940	0.000082
Lab	38	0.00099	0.00098	0.00099	0.00094	0.00097	0.00097	0.00002

Aluminum

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	2	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	3	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	4	0.	0.	0.	0.	0.		
Lab	5	0.016	0.014	0.013	0.014	0.014	0.014	0.001
Lab	6							
Lab	7	0.0101	0.0119	0.0092	0.0120	0.0126	0.0112	0.0014
Lab	8	0.35	0.70	0.57	0.68	0.35	0.53	0.17
Lab	9	0.05	<0.05	<0.05	<0.05	0.09	-	-
Lab	10	0.05	0.03	<0.02	<0.02	<0.02	-	-
Lab	11	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	12	<0.1	<0.1	<0.1	<0.1	0.1	-	-
Lab	13	0.016	0.017	<0.01	0.012	0.02	0.01	0.01
Lab	14	0.1	0.08	0.09	0.1	0.09	0.09	0.01
Lab	15	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	16	0.014	0.030	0.034	0.011	0.016	0.021	0.010
Lab	17	0.206	0.236	0.222	0.206	0.234	0.221	0.015
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.02						
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	<0.125	<0.125	<0.125	<0.125	<0.125	-	-
Lab	23	<0.50	<0.50	<0.50	<0.50	<0.50	-	-
Lab	24	<0.08	<0.07	<0.05	0.12	<0.06	-	-
Lab	25	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Lab	26	0.016	0.012	0.007	0.015	0.022	0.014	0.006
Lab	27	0.0400	0.0440	0.0340	0.0377	0.0385	0.0388	0.0036
Lab	28	<0.030	0.030	<0.030	<0.030	<0.030	-	-
Lab	29	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	30	0.204	0.231	0.189	0.206	0.234	0.213	0.019
Lab	31	<0.1	<0.10					
Lab	32							
Lab	33	<0.07	<0.07	<0.07	<0.07	<0.07	-	-
Lab	34	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	35	<0.07	<0.07	<0.07	<0.07	<0.07	-	-
Lab	36	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	37	0.00541	0.00581	0.00552	0.00561	0.00566	0.00560	0.00150
Lab	38	0.00657	0.00739	0.00650	0.00621	0.00665	0.00666	0.00043

Aluminum

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.12	0.11	0.12	0.11	0.12	0.12	0.01
Lab	2	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	3	0.08	0.08	0.08	0.06[D]	0.08	0.08	0.01
Lab	4	0	0	0	0	0	-	-
Lab	5	0.232	0.234	0.235	0.272	0.239	0.242*	0.017
Lab	6							
Lab	7	0.1390	0.1351	0.1402	0.1419	0.1364	0.139	0.003
Lab	8	0.50	0.44	0.70	0.44	0.63	0.54*	0.12
Lab	9	0.15	0.17	0.10	0.11	0.12	0.13	0.03
Lab	10	0.13	<0.02	0.16	0.05	<0.02	-	-
Lab	11	0.24	0.36	0.18	0.15	0.15	0.22	0.09
Lab	12	0.1	0.2	<0.1	0.1	<0.1	-	-
Lab	13	0.120	0.120	0.120	0.124	0.120	0.121	0.002
Lab	14	0.14	0.19	0.21	0.20	0.19	0.19	0.03
Lab	15	0.59	0.61	0.58	0.56	0.55	0.58*	0.02
Lab	16	0.124	0.097	0.116	0.058	0.133	0.106	0.030
Lab	17	0.374	0.365	0.376	0.380	0.367	0.372*	0.006
Lab	18	0.10	0.08	0.07	0.05	0.06	0.07	0.02
Lab	19							
Lab	20	<0.02						
Lab	21	0.07	0.07	0.08	0.07	0.09	0.08	0.01
Lab	22	<0.125	<0.125	<0.125	<0.125	<0.125	-	-
Lab	23	<0.50	<0.50	<0.50	<0.50	<0.50	-	-
Lab	24	0.19	0.19	0.12	0.23	0.12	0.17	0.05
Lab	25	0.1	0.1	0.1	0.1	0.1	0.1	0.00
Lab	26	0.116	0.117	0.109	0.130	0.123	0.119	0.008
Lab	27	0.134	0.143	0.131	0.135	0.130	0.135	0.005
Lab	28	0.156	0.154	0.162	0.140	0.148	0.152	0.008
Lab	29	0.59	0.58	0.58	0.57	0.56	0.58*	0.01
Lab	30	0.371	0.365	0.376	0.383	0.360	0.371*	0.009
Lab	31	0.13	0.15					
Lab	32							
Lab	33	0.081	0.083	0.082	0.083	0.081	0.082	0.001
Lab	34	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	35	0.076	0.107	0.106	0.093	0.118	0.100	0.016
Lab	36	<0.02	0.06	<0.02	0.06	0.06	-	-
Lab	37	0.147	0.149	0.149	0.151	0.153	0.150	0.002
Lab	38	0.150	0.162	0.1456	0.161	0.157	0.157	0.005

Aluminum

Sample C

mg/L

							Mean	Standard Deviation
Lab	1	0.55	0.57	0.55	0.57	0.56	0.56	0.01
Lab	2	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	3	0.57	0.56	0.56	0.55	0.57	0.56	0.01
Lab	4	0.	0.	0.	0.	0.		
Lab	5	1.242	1.040	1.010	1.114	0.922	1.07*	0.12
Lab	6							
Lab	7	0.640	0.660	0.730	0.560	0.690	0.656	0.063
Lab	8	0.84	0.89	0.90	0.75	0.98	0.87*	0.08
Lab	9	0.77	0.64	0.64	0.64	0.69	0.68	0.06
Lab	10	0.29	0.16	0.52	<0.02	0.37	0.34*	0.15
Lab	11	0.55	0.58	0.55	0.55	0.58	0.56	0.02
Lab	12	0.5	0.6	0.6	0.7	0.7	0.6	0.1
Lab	13	0.594	0.606	0.618	0.620	0.606	0.609	0.011
Lab	14	0.61	0.66	0.63	0.67	0.67	0.65	0.03
Lab	15	1.06	1.07	1.05	1.05	1.02	1.05*	0.02
Lab	16	0.57	0.52	0.61	0.49	0.48	0.53	0.06
Lab	17	0.534	0.530	0.541	0.530	0.527	0.532	0.005
Lab	18	0.58	0.51	0.58	0.68	0.54	0.58	0.06
Lab	19							
Lab	20	<0.02						
Lab	21	0.50	0.47	0.51	0.48	0.50	0.49	0.02
Lab	22	0.678	0.603	0.649	0.664	0.580	0.635	0.042
Lab	23	1.0	1.0	0.9	1.0	1.1	1.0*	0.1
Lab	24	0.69	0.68	0.66	0.72	0.60	0.67	0.04
Lab	25	0.3	0.3	0.3	0.3	0.3	0.3*	0.0
Lab	26	0.578	0.580	0.581	0.581	0.579	0.580	0.001
Lab	27	0.663	0.571	0.594	0.587	0.600	0.603	0.035
Lab	28	0.632	0.626	0.644	0.644	0.608	0.631	0.015
Lab	29	1.07	1.07	1.05	1.04	1.01	1.05*	0.02
Lab	30	0.532	0.530	0.540	0.537	0.533	0.534	0.004
Lab	31	0.58	0.70					
Lab	32							
Lab	33	0.341	0.345	0.344	0.342	0.343	0.343*	0.002
Lab	34	0.36	0.41	0.44	0.49	0.41	0.42	0.05
Lab	35	0.640	0.653	0.660	0.646	0.705	0.661	0.026
Lab	36	0.58	0.58	0.58	0.54	0.58	0.57	0.02
Lab	37	0.695	0.693	0.700	0.699	0.703	0.698	0.004
Lab	38	0.680	0.665	0.643	0.669	0.708	0.673	0.024

Aluminum

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	1.97	1.92	1.87	1.96	1.88	1.92	0.05
Lab	2	2.2	2.1	2.2	2.0	2.0	2.1	0.1
Lab	3	2.	2.	2.	2.	2.	2.	0.
Lab	4	1.3	1.7	1.4	1.4	1.2	1.4*	0.2
Lab	5	2.618	2.948	3.004	2.934	2.871	2.88*	0.15
Lab	6							
Lab	7	1.990	2.030	2.080	2.110	1.980	2.04	0.06
Lab	8	2.5	2.5	2.7	2.4	2.5	2.5	0.1
Lab	9	2.1	2.1	2.2	2.1	2.1	2.1	0.0
Lab	10	1.83	1.69	2.03	1.55	1.66	1.75	0.18
Lab	11	1.83	1.80	1.71	1.80	1.83	1.79	0.05
Lab	12	2.0	2.4	2.3	2.3	2.5	2.3	0.2
Lab	13	2.040	2.086	2.116	2.138	2.100	2.10	0.04
Lab	14	2.02	2.16	2.13	2.09	2.10	2.10	0.05
Lab	15	2.60	2.59	2.55	2.56	2.51	2.56*	0.04
Lab	16	1.9	2.0	1.8	1.7	1.8	1.8	0.1
Lab	17	1.126	1.097	1.125	1.125	1.119	1.12*	0.01
Lab	18	2.04	2.04	2.04	1.92	2.08	2.02	0.06
Lab	19							
Lab	20	<0.02						
Lab	21	1.68	1.72	1.73	1.74	1.78	1.73	0.04
Lab	22	2.24	1.83	1.94	1.80	2.17	2.00	0.20
Lab	23	2.0	2.2	2.0	1.9	2.2	2.1	0.1
Lab	24	2.23	2.24	2.17	2.30	2.11	2.21	0.07
Lab	25	1.0	1.0	0.9	0.9	0.9	0.9*	0.1
Lab	26	1.980	2.007	2.018	1.974	1.980	1.99	0.02
Lab	27	2.210	1.800	1.990	1.970	1.980	1.99	0.15
Lab	28	2.26	2.22	2.28	2.24	2.28	2.26	0.03
Lab	29	2.61	2.60	2.55	2.54	2.50	2.56*	0.05
Lab	30	1.124	1.087	1.135	1.128	1.118	1.12*	0.02
Lab	31	2.27	2.00					
Lab	32							
Lab	33	2.08	2.06	2.05	2.03	2.06	2.06	0.02
Lab	34	1.90	1.80	1.88	1.85	1.69	1.82	0.08
Lab	35	2.29	2.32	2.30	2.35	2.41	2.33	0.05
Lab	36	2.0	2.1	2.0	2.1	2.1	2.1	0.1
Lab	37	2.26	2.29	2.33	2.33	2.29	2.30	0.03
Lab	38	2.05	1.97	2.02	2.15	2.23	2.09	0.1

Vanadium

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	0.0016	0.0018	<0.0012	0.0024	0.0013	0.0014	0.0009
Lab	2							
Lab	3	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.30	<0.30	<0.30	<0.30	<0.30	-	-
Lab	9	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	10	<0.01	0.02	0.02	0.01	0.02	0.02	0.01
Lab	11	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	12							
Lab	13	0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	14	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16							
Lab	17	0.114	0.121	0.129	0.117	0.123	0.121	0.006
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.04						
Lab	21	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	22	<0.250	<0.250	<0.250	<0.250	<0.250	-	-
Lab	23	<0.20	<0.20	<0.20	<0.20	<0.20	-	-
Lab	24	<0.018	<0.036	<0.036	<0.036	<0.010	-	-
Lab	25	0.01	0.015	0.015	0.005	0.015	0.012	0.004
Lab	26	0.003	0.003	0.001	0.003	0.003	0.003	0.001
Lab	27	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	28	<0.030	<0.030	<0.030	<0.030	<0.030	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	0.111	0.124	0.131	0.116	0.120	0.120	0.008
Lab	31							
Lab	32	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	33	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	34	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	35	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	38	0.00033	0.00056	0.00051	0.00058	0.00062	0.00052	0.00011

Vanadium

Sample B
mg/L

							Mean	Standard Deviation
Lab	1	0.0106	0.0114	0.0120	0.0106	0.0117	0.0113	0.0006
Lab	2							
Lab	3	0.009	0.008	0.008	0.009	0.009	0.009	0.001
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.30	<0.30	<0.30	<0.30	<0.30	-	-
Lab	9	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Lab	10	0.03	<0.01	0.02	0.03	0.02	0.03	0.01
Lab	11	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	12							
Lab	13	0.0102	0.0102	0.0100	0.0108	0.0104	0.0103	0.0003
Lab	14	0.008	0.008	0.008	0.009	0.008	0.008	0.000
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16							
Lab	17	0.120	0.112	0.123	0.128	0.128	0.122	0.007
Lab	18	0.01	<0.01	<0.01	0.01	0.01	-	-
Lab	19							
Lab	20	<0.04						
Lab	21	0.008	0.012	0.011	0.012	0.011	0.011	0.002
Lab	22	<0.250	<0.250	<0.250	<0.250	<0.250	-	-
Lab	23	<0.20	<0.20	<0.20	<0.20	<0.20	-	-
Lab	24	<0.023	<0.019	<0.036	<0.011	<0.015	-	-
Lab	25	0.015	0.02	0.02	0.03	0.015	0.020	0.006
Lab	26	0.011	0.012	0.012	0.012	0.011	0.012	0.001
Lab	27	0.0138	0.0135	0.0127	0.0125	0.0115	0.0128	0.0009
Lab	28	<0.030	<0.030	<0.030	<0.030	<0.030	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	0.121	0.108	0.126	0.133	0.126	0.123	0.009
Lab	31							
Lab	32	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	33	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	34	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	35	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	0.0113	0.0115	0.0115	0.0119	0.0121	0.0117	0.0003
Lab	38	0.0096	0.0097	0.0108	0.0107	0.0110	0.0104	0.0007

Vanadium

Sample C

mg/L

							Mean	Standard Deviation
Lab	1	0.0287	0.0289	0.0289	0.0297	0.0297	0.0292	0.0005
Lab	2							
Lab	3	0.028	0.028	0.028	0.027	0.029	0.028	0.001
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.30	<0.30	<0.30	<0.30	<0.30	-	-
Lab	9	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Lab	10	0.04	0.04	0.04	0.03	0.06	0.04	0.01
Lab	11	0.028	0.028	0.028	0.028	0.028	0.028	0.000
Lab	12							
Lab	13	0.0300	0.0298	0.0294	0.0300	0.0292	0.0297	0.0004
Lab	14	0.026	0.023	0.025	0.025	0.023	0.024	0.001
Lab	15	0.03	0.03	0.03	0.03	0.02	0.03	0.00
Lab	16							
Lab	17	0.130	0.125	0.122	0.125	0.131	0.127*	0.004
Lab	18	0.03	0.04	0.02	0.05	0.03	0.03	0.01
Lab	19							
Lab	20	<0.04						
Lab	21	0.022	0.024	0.026	0.026	0.025	0.025	0.002
Lab	22	<0.250	<0.250	<0.250	<0.250	<0.250	-	-
Lab	23	<0.20	<0.20	<0.20	<0.20	<0.20	-	-
Lab	24	0.047	<0.035	0.037	<0.031	0.037	-	-
Lab	25	0.025	0.03	0.025	0.03	0.025	0.027	0.003
Lab	26	0.030	0.030	0.030	0.030	0.030	0.030	0.00
Lab	27	0.0317	0.0313	0.0284	0.0289	0.0292	0.0299	0.0015
Lab	28	<0.030	<0.030	0.032	0.034	<0.030	-	-
Lab	29	0.03	0.03	0.03	0.03	0.02	0.03	0.00
Lab	30	0.131	0.126	0.121	0.130	0.125	0.127*	0.004
Lab	31							
Lab	32	0.021	0.022	0.022	0.019	0.024	0.022	0.002
Lab	33	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	34	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	35	0.022	0.028	0.031	0.030	0.032	0.029	0.004
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	0.0320	0.0321	0.0323	0.0320	0.0325	0.0321	0.0002
Lab	38	0.0267	0.0267	0.0277	0.0272	0.0277	0.0272	0.0005

Vanadium

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.0918	0.0884	0.0869	0.0903	0.0972	0.0909	0.0040
Lab	2							
Lab	3	0.09	0.089	0.09	0.089	0.09	0.090	0.001
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.30	<0.30	<0.30	<0.30	<0.30	-	-
Lab	9	0.09	0.09	0.09	0.09	0.09	0.09	0.00
Lab	10	0.11	0.09	0.08	0.09	0.09	0.09	0.01
Lab	11	0.110	0.110	0.110	0.083[D]	0.110	0.110	0.000
Lab	12							
Lab	13	0.0916	0.0904	0.0906	0.0932	0.0928	0.0917	0.0013
Lab	14	0.075	0.073	0.078	0.073	0.069	0.074	0.003
Lab	15	0.10	0.10	0.10	0.10	0.09	0.10	0.00
Lab	16							
Lab	17	0.124	0.118	0.127	0.130	0.120	0.124	0.005
Lab	18	0.08	0.12	0.04	0.08	0.09	0.08	0.03
Lab	19							
Lab	20	<0.04						
Lab	21	0.084	0.083	0.082	0.088	0.086	0.085	0.002
Lab	22	<0.250	<0.250	<0.250	<0.250	<0.250	-	-
Lab	23	<0.20	<0.20	<0.20	<0.20	<0.20	-	-
Lab	24	0.10	0.096	0.10	0.099	0.099	0.099	0.002
Lab	25	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Lab	26	0.087	0.089	0.090	0.088	0.088	0.088	0.001
Lab	27	0.079	0.0789	0.0838	0.0846	0.0844	0.0821	0.0029
Lab	28	0.116	0.116	0.114	0.116	0.108	0.114	0.003
Lab	29	0.10	0.10	0.10	0.10	0.09	0.10	0.00
Lab	30	0.126	0.119	0.124	0.133	0.122	0.125	0.005
Lab	31							
Lab	32	0.080	0.071	0.078	0.068	0.073	0.074	0.005
Lab	33	0.064	0.049	0.054	0.060	<0.04	0.057	0.006
Lab	34	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Lab	35	0.095	0.102	0.103	0.104	0.106	0.102	0.004
Lab	36	0.22	0.22	0.22	0.22	0.22	0.22*	0.00
Lab	37	0.0980	0.0964	0.0965	0.0674	0.0974	0.0971	0.0007
Lab	38	0.0959	0.0833	0.0939	0.0864	0.0912	0.0901	0.0052

Chromium

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	0.0018	0.0025	0.0014	0.0018	0.0014	0.0018	0.0004
Lab	2	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	3	<0.004	<0.004	<0.004	<0.004	<0.004	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	6	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	7	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	8	0.005	0.002	0.008	0.004	0.009	0.006	0.003
Lab	9	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	10	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12	<0.01	<0.01	<0.01	0.01	0.01	-	-
Lab	13	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	14	<0.0005	0.0005	<0.0005	0.0006	0.0006	-	-
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.01	0.001	0.005	<0.10	<0.10	-	-
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	0.02	-	-
Lab	19	0.0047	0.0033	0.0018	0.0047	0.0018	0.0033	0.0015
Lab	20	<0.03	0.01					
Lab	21	<0.007	<0.007	<0.007	<0.007	<0.007	-	-
Lab	22	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	-	-
Lab	23	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	24	<0.01	0.011	0.014	0.014	<0.01	-	-
Lab	25	0.005	0.02	0.01	0.01	0.005	0.010	0.006
Lab	26	0.007	0.007	0.007	0.008	0.008	0.007	0.001
Lab	27	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	28	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	<0.01	<0.01					
Lab	32	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	33	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.000260	0.000248	0.000251	0.000236	0.000217	0.000242	0.000017
Lab	38	0.00020	0.00024	0.00019	0.00022	0.00028	0.00023	0.00004

Chromium

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.0120	0.0118	0.0121	0.0116	0.0111	0.0117	0.0004
Lab	2	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	3	0.012	0.012	0.012	0.011	0.012	0.012	0.000
Lab	4	0	0.1	0	0	0.1		
Lab	5	0.0193	0.0151	0.0144	0.0149	0.0154	0.0158	0.0020
Lab	6	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	7	0.00996	0.01012	0.01010	0.01005	0.00968	0.00998	0.00018
Lab	8	0.007	0.008	0.017	0.020	0.015	0.013	0.006
Lab	9	0.02	0.02	0.02	0.02	0.01	0.02	0.00
Lab	10	0.02	<0.02	<0.02	0.04	0.04	-	-
Lab	11	0.01	<0.010	0.01	<0.010	<0.010	-	-
Lab	12	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	13	0.0100	0.0105	0.0080[D]	0.0100	0.0105	0.0103	0.0003
Lab	14	0.013	0.013	0.013	0.013	0.013	0.013	0.00
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.021	0.008	0.009	0.013	0.012	0.013	0.005
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	0.03	<0.01	0.01	<0.01	-	-
Lab	19	0.0121	0.0121	0.0121	0.0135[D]	0.0121	0.0121	0.0000
Lab	20	<0.03	0.02					
Lab	21	0.012	0.011	0.010	0.010	0.011	0.011	0.001
Lab	22	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	-	-
Lab	23	0.015	0.014	0.016	0.013	0.015	0.015	0.001
Lab	24	0.018	0.027	0.014	0.022	0.016	0.019	0.005
Lab	25	0.015	0.020	0.015	0.015	0.010	0.015	0.004
Lab	26	0.018	0.019	0.019	0.019	0.019	0.019	0.000
Lab	27	0.0126	0.0126	0.0114	0.0123	0.0110	0.0120	0.0007
Lab	28	0.011	0.010	0.011	0.010	0.010	0.010	0.001
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	0.16	0.15					
Lab	32	0.012	0.012	0.013	0.011	0.011	0.012	0.001
Lab	33	0.00819	0.00830	0.00793	0.00801	0.00783	0.00805	0.00019
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.0128	0.0133	0.0143	0.0136	0.0130	0.0134	0.0006
Lab	38	0.0119	0.0119	0.0116	0.0110	0.0107	0.0114	0.0006

Chromium

Sample C

mg/L

							Mean	Standard Deviation
Lab	1	0.0169	0.0168	0.0169	0.0174	0.0169	0.0170	0.0002
Lab	2	0.04	0.03	0.03	0.05	0.03	0.04*	0.01
Lab	3	0.018	0.019	0.016	0.017	0.017	0.017	0.001
Lab	4	0.1	0	0	0.1	0		
Lab	5	0.0216	0.0222	0.0218	0.0224	0.0232	0.0222	0.0006
Lab	6	<0.01	0.01	<0.01	0.02	<0.01	-	-
Lab	7	0.01467	0.01557	0.01540	0.01582	0.01532	0.0154	0.0004
Lab	8	0.014	0.014	0.023	0.024	0.026	0.020	0.006
Lab	9	0.03	0.03	0.03	0.03	0.03	0.03*	0.00
Lab	10	<0.02	<0.02	<0.02	0.03	0.02	-	-
Lab	11	0.020	0.020	0.013[D]	0.020	0.020	0.020	0.000
Lab	12	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	13	0.0160	0.0160	0.0135	0.0150	0.0155	0.0152	0.0010
Lab	14	0.020	0.020	0.019	0.020	0.019	0.020	0.001
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.024	0.017	0.012	0.020	0.013	0.017	0.005
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.0150	0.0150	0.0135[D]	0.0150	0.0150	0.0150	0.0000
Lab	20	0.03	0.02					
Lab	21	0.018	0.015	0.013	0.013	0.017	0.015	0.002
Lab	22	0.0250	0.0250	0.0250	0.0250	0.0289[D]	0.0250	0.000
Lab	23	0.022	0.020	0.021	0.024	0.022	0.022	0.001
Lab	24	0.021	0.027	0.032	0.026	0.024	0.026	0.004
Lab	25	0.035	0.02	0.01	0.015	0.015	0.019	0.010
Lab	26	0.024	0.025	0.024	0.024	0.026	0.025	0.001
Lab	27	0.0165	0.0212	0.0165	0.0181	0.0180	0.0181	0.0019
Lab	28	0.017	0.017	0.017	0.015	0.015	0.016	0.001
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	0.01	0.01					
Lab	32	0.016	0.015	0.016	0.016	0.015	0.016	0.001
Lab	33	0.00994	0.00901	0.00954	0.01050	0.00963	0.00972	0.00055
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.0183	0.0193	0.0198	0.0190	0.0193	0.0191	0.0005
Lab	38	0.0170	0.0172	0.0172	0.0169	0.0168	0.0170	0.0002

Chromium

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.0466	0.0459	0.0457	0.0460	0.0444	0.0457	0.0008
Lab	2	0.05	0.04	0.05	0.04	0.04	0.04	0.01
Lab	3	0.047	0.046	0.047	0.047	0.046	0.047	0.001
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1*	0.0
Lab	5	0.0523	0.0550	0.0541	0.0565	0.0566	0.0549	0.0018
Lab	6	0.02	0.04	0.04	0.05	0.02	0.03	0.01
Lab	7	0.04423	0.04314	0.04051	0.04432	0.04228	0.0429	0.0016
Lab	8	0.045	0.039	0.054	0.058	0.054	0.050	0.008
Lab	9	0.05	0.06	0.07	0.06	0.06	0.06	0.01
Lab	10	0.07	0.06	0.07	0.07	0.09	0.07	0.01
Lab	11	0.044	0.041	0.044	0.044	0.044	0.043	0.001
Lab	12	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Lab	13	0.0445	0.0440	0.0445	0.0450	0.0440	0.0444	0.0004
Lab	14	0.050	0.050	0.050	0.047	0.047	0.049	0.002
Lab	15	0.04	0.04	0.03	0.03	0.03	0.03	0.01
Lab	16	0.054	0.045	0.044	0.043	0.041	0.045	0.005
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	0.05	0.04	<0.01	0.04	0.05	0.05	0.01
Lab	19	0.0429	0.0458	0.0458	0.0458	0.0472	0.0455	0.0016
Lab	20	0.05	0.04					
Lab	21	0.044	0.044	0.042	0.045	0.049	0.045	0.003
Lab	22	0.0588	0.0575	0.0613	0.0625	0.0596	0.0599	0.0020
Lab	23	0.044	0.040	0.042	0.044	0.041	0.042	0.002
Lab	24	0.050	0.060	0.056	0.064	0.046	0.055	0.007
Lab	25	0.035	0.035	0.035	0.03	0.03	0.033	0.003
Lab	26	0.051	0.053	0.053	0.051	0.052	0.052	0.001
Lab	27	0.0467	0.0488	0.0459	0.0463	0.0463	0.0468	0.0012
Lab	28	0.043	0.043	0.042	0.042	0.043	0.043	0.001
Lab	29	0.04	0.04	0.04	0.04	0.02	0.04	0.01
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	0.04	0.05					
Lab	32	0.049	0.049	0.047	0.051	0.050	0.049	0.001
Lab	33	0.037	0.038	0.025	0.032	0.042	0.035	0.007
Lab	34	0.08	0.06	0.07	0.09	0.08	0.08*	0.01
Lab	35	0.027	0.037	0.036	0.036	0.045	0.036	0.006
Lab	36	0.025	0.026	0.026	0.026	0.026	0.026	0.000
Lab	37	0.0489	0.0499	0.0514	0.0508	0.0497	0.0501	0.0010
Lab	38	0.0449	0.0472	0.0462	0.0447	0.0470	0.0460	0.0012

Cobalt

Sample A
mg/L

							Mean	Standard Deviation
Lab	1	0.0014	<0.0009	<0.0009	0.0014	<0.0009	-	-
Lab	2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	4							
Lab	5	0.0108	0.0104	0.0101	0.0099	0.0100	0.0102	0.0004
Lab	6	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	7							
Lab	8	<0.01	0.02	0.01	<0.01	<0.01	-	-
Lab	9	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	10	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12							
Lab	13	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	14	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Lab	15	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	16	<0.10	0.009	0.002	0.006	0.006	0.006	0.003
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.0015	0.0015	0.0024	0.0024	0.0015	0.0019	0.0005
Lab	20	<0.01	0.01					
Lab	21	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	22	<0.0313	<0.0313	<0.0313	<0.0313	<0.0313	-	-
Lab	23	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	24	<0.006	<0.003	<0.004	<0.003	<0.002	-	-
Lab	25	0.005	0.005	<0.005	<0.005	<0.005	-	-
Lab	26	0.001	0.001	0.000	0.001	0.002	0.001	0.001
Lab	27	<0.003	<0.003	<0.003	<0.003	<0.003	-	-
Lab	28	<0.013	<0.013	<0.013	<0.013	<0.013	-	-
Lab	29	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	<0.01	<0.01					
Lab	32	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	33	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.000600	0.000588	0.000577	0.000605	0.000579	0.000590	0.000012
Lab	38	0.00049	0.00044	0.00045	0.00042	0.00043	0.00045	0.00003

Cobalt

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.0091	0.0085	0.0083	0.0085	0.0085	0.0086	0.0003
Lab	2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	<0.01	<0.01	0.01	<0.01	<0.01	-	-
Lab	4							
Lab	5	0.0154	0.0163	0.0175	0.0175	0.0171	0.0168*	0.0009
Lab	6	0.010	0.003	0.018	0.012	0.013	0.011	0.005
Lab	7							
Lab	8	0.02	0.01	0.02	0.01	0.01	0.01	0.01
Lab	9	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	10	0.02	<0.02	<0.02	<0.02	0.03	-	-
Lab	11	0.013	0.013	0.013	0.010	0.013	0.012	0.001
Lab	12							
Lab	13	0.0080	0.0075	0.0075	0.0085	0.0080	0.0080	0.0004
Lab	14	0.0081	0.0081	0.0080	0.0079	0.0079	0.0080	0.0001
Lab	15	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	16	0.001	0.014	0.005	0.011	0.011	0.008	0.005
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.0078	0.0078	0.0078	0.0078	0.0069	0.0078	0.0004
Lab	20	0.025	0.020					
Lab	21	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	22	<0.0313	<0.0313	<0.0313	<0.0313	<0.0313	-	-
Lab	23	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	24	0.011	0.015	0.010	0.013	0.008	0.011	0.003
Lab	25	0.005	0.005	0.005	0.005	<0.005	0.005	0.000
Lab	26	0.009	0.009	0.009	0.008	0.009	0.009	0.001
Lab	27	0.0114	0.0106	0.0106	0.0109	0.0104	0.0108	0.0004
Lab	28	0.014	0.016	0.016	0.014	0.014	0.015*	0.001
Lab	29	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	0.01	0.01					
Lab	32	0.005	0.008	0.006	0.009	0.006	0.007	0.002
Lab	33	0.0085	0.0049	0.0060	0.0056	0.0084	0.0067	0.0017
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	36	0.009	0.009	0.009	0.009	0.009	0.009	0.000
Lab	37	0.00807	0.00818	0.00818	0.00830	0.00834	0.00821	0.00011
Lab	38	0.00844	0.00867	0.00867	0.00876	0.00875	0.00866	0.00013

Cobalt

Sample C

mg/L

							Mean	Standard Deviation
Lab	1	0.0138	0.0141	0.0148	0.0153	0.0148	0.0146	0.0006
Lab	2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	4							
Lab	5	0.0247	0.0255	0.0249	0.0239	0.0234	0.0245	0.0008
Lab	6	0.013	0.013	0.015	0.017	0.009	0.013	0.003
Lab	7							
Lab	8	0.03	0.03	0.02	0.03	0.02	0.03*	0.01
Lab	9	0.03	0.03	0.02	0.03	0.03	0.03*	0.00
Lab	10	0.03	<0.02	<0.02	0.02	<0.02	-	-
Lab	11	0.021	0.019	0.019	0.019	0.019	0.019	0.001
Lab	12							
Lab	13	0.0155	0.0150	0.0155	0.0160	0.0150	0.0154	0.0004
Lab	14	0.017	0.016	0.017	0.016	0.016	0.016	0.001
Lab	15	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	16	0.005	0.021	0.019	0.022	0.013	0.016	0.007
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	0.01	0.01	0.01	0.01	0.01	0.01
Lab	19	0.0141	0.0132	0.0150	0.0150	0.0150	0.0145	0.0008
Lab	20	0.037	0.035					
Lab	21	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	22	<0.0313	<0.0313	<0.0313	<0.0313	<0.0313	-	-
Lab	23	0.022	0.021	0.023	0.020	0.022	0.022	0.001
Lab	24	0.015	0.015	0.020	0.020	0.014	0.017	0.003
Lab	25	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Lab	26	0.016	0.016	0.016	0.016	0.016	0.016	0.000
Lab	27	0.0184	0.0192	0.0186	0.0173	0.0172	0.0181	0.0009
Lab	28	0.022	0.022	0.022	0.020	0.018	0.021	0.002
Lab	29	<0.02	0.02	<0.02	<0.02	<0.02	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	0.02	0.02					
Lab	32	0.020	0.018	0.020	0.020	0.019	0.019	0.001
Lab	33	0.0060	0.0065	0.0066	0.0062	0.0059	0.0062	0.0003
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	36	0.010	0.025[D]	0.010	0.010	0.010	0.010	0.000
Lab	37	0.0164	0.0164	0.0164	0.0165	0.0166	0.0165	0.0001
Lab	38	0.0161	0.0157	0.0154	0.0150	0.0163	0.0157	0.0005

Cobalt

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.0267	0.0287	0.0272	0.0269	0.0264	0.0272	0.0009
Lab	2	0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Lab	4							
Lab	5	0.0336	0.0395	0.0380	0.0389	0.0378	0.0376	0.0023
Lab	6	0.019	0.025	0.021	0.033	0.012	0.022	0.008
Lab	7							
Lab	8	0.03	0.03	0.04	0.05	0.03	0.04	0.01
Lab	9	0.04	0.04	0.04	0.04	0.04	0.04	0.00
Lab	10	0.04	0.04	0.04	0.04	0.05	0.04	0.00
Lab	11	0.027	0.027	0.027	0.027	0.027	0.027	0.000
Lab	12							
Lab	13	0.0280	0.0270	0.0280	0.0285	0.0280	0.0279	0.0005
Lab	14	0.030	0.029	0.030	0.029	0.030	0.030	0.001
Lab	15	0.02	0.02	<0.02	<0.02	<0.02	-	-
Lab	16	0.014	0.037	0.027	0.034	0.028	0.028	0.009
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Lab	19	0.0231	0.0240	0.0249	0.0231	0.0240	0.0238	0.0008
Lab	20	0.05	0.04					
Lab	21	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	22	0.0425	0.0400[D]	0.0425	0.0425	0.0423	0.0425	0.0000
Lab	23	0.035	0.031	0.033	0.034	0.035	0.034	0.002
Lab	24	0.030	0.033	0.032	0.034	0.025	0.031	0.004
Lab	25	0.015	0.02[D]	0.015	0.015	0.015	0.015	0.000
Lab	26	0.028	0.029	0.028	0.028	0.027	0.028	0.001
Lab	27	0.0319	0.0311	0.0306	0.0281	0.0298	0.0303	0.0014
Lab	28	0.034	0.036	0.032	0.040	0.032	0.035	0.003
Lab	29	0.03	0.03	0.02	0.02	0.03	0.03	0.01
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	0.03	0.03					
Lab	32	0.036	0.035	0.033	0.033	0.032	0.034	0.002
Lab	33	0.00850	0.00895	0.00800	0.00883	0.00865	0.00859	0.00037
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	0.048	0.024	0.037	0.027	0.046	0.036	0.011
Lab	36	0.041	0.041	0.041	0.041	0.041	0.041	0.000
Lab	37	0.0295	0.0291	0.0292	0.0297	0.0296	0.0294	0.0003
Lab	38	0.0266	0.0296	0.0277	0.0285	0.0288	0.0282	0.0011

Nickel

Sample A
mg/L

							Mean	Standard Deviation
Lab	1	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	2	<0.06	<0.06	<0.06	<0.06	<0.06	-	-
Lab	3	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5	0.028	0.026	0.029	0.030	0.030	0.029	0.002
Lab	6	0.006	0.032[D]	0.012	0.012	0.008	0.010	0.003
Lab	7	0.00343	0.00346	0.00403	0.00280	0.00352	0.00345	0.00044
Lab	8	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	9	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	10	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	13	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	14	0.0029	0.0024	0.003	0.0021	0.0027	0.0026	0.0004
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.02	<0.10	0.009	<0.10	<0.10	-	-
Lab	17	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	18	<0.01	0.01	<0.01	<0.01	<0.01	-	-
Lab	19	<0.002	0.008	0.005	<0.002	0.005	-	-
Lab	20	0.01	0.008					
Lab	21	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	22	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	-	-
Lab	23	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	24	<0.009	<0.010	<0.012	<0.003	<0.012	-	-
Lab	25	0.05	0.05	0.05	0.05	0.044	0.049	0.003
Lab	26	0.032	0.026	0.024	0.028	0.032	0.028	0.004
Lab	27	0.00600	0.00600	0.00690	0.00700	0.00600	0.00638	0.00052
Lab	28	<0.014	<0.014	<0.014	<0.014	<0.014	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	31	<0.01	<0.01					
Lab	32	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	33	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	34	<0.05	0.06	<0.05	<0.05	<0.05	-	-
Lab	35	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	38	0.00294	0.00320	0.00304	0.00290	0.00290	0.00300	0.0012

Nickel

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.034	0.031	0.032	0.026	0.031	0.031	0.003
Lab	2	<0.06	<0.06	<0.06	<0.06	<0.06	-	-
Lab	3	0.03	0.03	0.03	0.03	0.03	0.03	0
Lab	4	0	0	0	0	0		
Lab	5	0.065	0.067	0.066	0.065	0.066	0.066*	0.001
Lab	6	0.038	0.072[D]	0.036	0.041	0.037	0.038	0.002
Lab	7	0.03078	0.03208	0.03346	0.02829	0.03005	0.0309	0.0020
Lab	8	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	9	0.02	0.02	0.04	0.03	0.03	0.03	0.01
Lab	10	<0.02	<0.02	<0.02	0.04	0.02	-	-
Lab	11	0.028	0.028	0.028	0.028	0.028	0.028	0.000
Lab	12	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	13	0.030	0.030	0.030	0.030	0.032	0.030	0.001
Lab	14	0.032	0.031	0.033	0.033	0.033	0.032	0.001
Lab	15	0.03	<0.01	0.02	<0.01	<0.01	-	-
Lab	16	0.029	0.024	0.029	0.023	0.028	0.027	0.003
Lab	17	0.024	0.027	0.024	0.021	0.026	0.024	0.002
Lab	18	0.03	0.02	0.02	0.02	0.02	0.02	0.00
Lab	19	0.033	0.041	0.044	0.028	0.028	0.035	0.007
Lab	20	0.037	0.039					
Lab	21	0.02	0.02	0.02	0.03	0.02	0.02	0.00
Lab	22	0.0275	0.0288	0.0313	0.0313	0.0281	0.0294	0.0018
Lab	23	0.035	0.033	0.028	0.036	0.037	0.034	0.004
Lab	24	0.050	0.034	0.021	0.027	0.026	0.032	0.011
Lab	25	0.05	0.1[D]	0.05	0.05	0.05	0.05*	0.00
Lab	26	0.056	0.059	0.059	0.060	0.057	0.058*	0.002
Lab	27	0.0340	0.0352	0.0315	0.0339	0.0346	0.0338	0.0014
Lab	28	0.032	0.034	0.034	0.034	0.032	0.033	0.001
Lab	29	0.03	0.03	0.03	0.02	0.04	0.03	0.01
Lab	30	0.024	0.030	0.022	0.025	0.023	0.025	0.003
Lab	31	0.36	0.33					
Lab	32	0.028	0.027	0.029	0.037	0.030	0.030	0.004
Lab	33	0.0230	0.0221	0.0194	0.0133	0.0238	0.0203	0.0043
Lab	34	<0.05	0.06	0.08	0.09	0.09	0.08*	0.01
Lab	35	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	36	0.048	0.048	0.048	0.048	0.048	0.048	0.000
Lab	37	0.0364	0.0367	0.0366	0.0370	0.0369	0.0367	0.0002
Lab	38	0.0337	0.0345	0.0341	0.0342	0.0342	0.0341	0.0003

Nickel

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	0.214	0.219	0.217	0.221	0.215	0.217	0.003
Lab	2	0.26	0.21	0.22	0.21	0.26	0.23	0.03
Lab	3	0.24	0.24	0.23	0.24	0.24	0.24	0.00
Lab	4	0.3	0.3	0.3	0.3	0.3	0.3*	0.0
Lab	5	0.335	0.314	0.314	0.331	0.324	0.324*	0.010
Lab	6	0.244	0.281	0.229	0.231	0.232	0.243	0.022
Lab	7	0.260	0.260	0.240	0.250	0.230	0.248	0.013
Lab	8	0.21	0.23	0.18	0.21	0.24	0.21	0.02
Lab	9	0.28	0.27	0.25	0.26	0.25	0.26	0.01
Lab	10	0.34	0.30	0.27	0.29	0.29	0.30*	0.03
Lab	11	0.226	0.221	0.223	0.226	0.223	0.224	0.002
Lab	12	0.22	0.22	0.21	0.22	0.20	0.21	0.01
Lab	13	0.226	0.222	0.226	0.230	0.224	0.226	0.003
Lab	14	0.25	0.25	0.24	0.24	0.24	0.24	0.01
Lab	15	0.23	0.23	0.22	0.22	0.20	0.22	0.01
Lab	16	0.23	0.19	0.19	0.18	0.18	0.19	0.02
Lab	17	0.233	0.241	0.229	0.240	0.236	0.236	0.005
Lab	18	0.22	0.22	0.21	0.22	0.21	0.22	0.01
Lab	19	0.240	0.240	0.246	0.232	0.233	0.238	0.006
Lab	20	0.25	0.24					
Lab	21	0.21	0.20	0.21	0.20	0.21	0.21	0.01
Lab	22	0.240	0.230	0.240	0.239	0.228	0.235	0.006
Lab	23	0.280	0.275	0.291	0.294	0.285	0.285*	0.008
Lab	24	0.30[D]	0.24	0.24	0.24	0.22	0.24	0.01
Lab	25	0.15	0.15	0.15	0.1	0.1	0.13*	0.03
Lab	26	0.244	0.247	0.246	0.245	0.243	0.245	0.002
Lab	27	0.217	0.217	0.218	0.208	0.209	0.214	0.005
Lab	28	0.248	0.240	0.248	0.242	0.235	0.243	0.006
Lab	29	0.25	0.25	0.27	0.27	0.25	0.26	0.01
Lab	30	0.235	0.226	0.245	0.233	0.219	0.232	0.010
Lab	31	0.23	0.20					
Lab	32	0.256	0.260	0.259	0.262	0.263	0.260	0.003
Lab	33	0.2373	0.2397	0.2387	0.2349	0.2407	0.238	0.002
Lab	34	0.29	0.26	0.28	0.23	0.25	0.26	0.02
Lab	35	0.248	0.245	0.234	0.253	0.243	0.245	0.007
Lab	36	0.32	0.32	0.33	0.33	0.32	0.32*	0.01
Lab	37	0.245	0.243	0.246	0.242	0.243	0.244	0.002
Lab	38	0.262	0.255	0.247	0.250	0.243	0.251	0.007

Nickel

Sample D
mg/L

							Mean	Standard Deviation
Lab	1	0.680	0.651	0.647	0.668	0.643	0.658	0.016
Lab	2	0.78	0.76	0.70	0.70	0.67	0.72	0.05
Lab	3	0.74	0.73	0.71	0.72	0.73	0.73	0.01
Lab	4	0.9	0.9	0.9	0.9	0.9	0.9*	0.0
Lab	5	0.906	0.910	0.909	0.950	0.935	0.922*	0.020
Lab	6	0.682	0.718	0.667	0.669	0.671	0.681	0.021
Lab	7	0.770	0.780	0.750	0.730	0.745	0.755	0.020
Lab	8	0.70	0.73	0.65	0.73	0.70	0.70	0.03
Lab	9	0.76	0.74	0.75	0.77	0.74	0.75	0.01
Lab	10	0.81	0.84	0.84	0.88	0.84	0.84*	0.02
Lab	11	0.633	0.636	0.645[D]	0.633	0.636	0.635	0.002
Lab	12	0.70	0.71	0.68	0.69	0.70	0.70	0.01
Lab	13	0.684	0.680	0.684	0.694	0.694	0.687	0.006
Lab	14	0.73	0.78	0.75	0.73	0.72	0.74	0.02
Lab	15	0.72	0.70	0.70	0.70	0.66	0.70	0.02
Lab	16	0.72	0.63	0.59	0.56	0.57	0.61	0.07
Lab	17	0.771	0.777	0.706	0.803	0.775	0.766	0.036
Lab	18	0.57[D]	0.66	0.64	0.64	0.66	0.65	0.01
Lab	19	0.746	0.746	0.716	0.721	0.723	0.730	0.014
Lab	20	0.76	0.75					
Lab	21	0.63	0.62	0.62	0.65	0.66	0.64	0.02
Lab	22	0.738	0.638	0.715	0.698	0.738	0.705	0.041
Lab	23	0.600	0.575	0.615	0.620	0.590	0.600	0.018
Lab	24	0.85	0.80	0.79	0.81	0.72	0.79	0.05
Lab	25	0.3	0.45[D]	0.3	0.3	0.3	0.3*	0.0
Lab	26	0.681	0.693	0.694	0.681	0.684	0.687	0.006
Lab	27	0.625	0.622	0.633	0.629	0.629	0.628	0.004
Lab	28	0.776	0.790	0.792	0.784	0.778	0.784	0.007
Lab	29	0.74	0.70	0.71	0.71	0.67	0.71	0.03
Lab	30	0.773	0.779	0.698	0.826	0.766	0.768	0.046
Lab	31	0.68	0.76					
Lab	32	0.788	0.774	0.780	0.767	0.787	0.779	0.009
Lab	33	0.747	0.753	0.755	0.751	0.749	0.749	0.003
Lab	34	0.65	0.64	0.73	0.67	0.68	0.67	0.04
Lab	35	0.859	0.807	0.802	0.816	0.834	0.824	0.023
Lab	36	0.90	0.86	0.90	0.85	0.88	0.88*	0.02
Lab	37	0.704	0.717	0.714	0.718	0.710	0.713	0.006
Lab	38	0.656	0.689	0.729	0.724	0.714	0.702	0.030

Copper

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	<0.004	<0.004	<0.004	<0.004	<0.004	-	-
Lab	2	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	3	0.008	<0.006	<0.006	<0.006	<0.006	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5	0.0082	0.0075	0.0086	0.0073	0.0077	0.008	0.001
Lab	6	0.007	0.007	0.009	0.008	0.009	0.008	0.001
Lab	7	0.050	0.030	0.030	0.040	0.060	0.042	0.013
Lab	8	0.035	0.035	0.025	0.025	0.035	0.031	0.005
Lab	9	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	10	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12	0.01	0.01	<0.01	<0.01	<0.01	-	-
Lab	13	0.0030	<0.002	0.0020	0.0030	0.0035	0.0028	0.0006
Lab	14	0.0032	0.0035	0.0039	0.0036	0.0034	0.0035	0.0003
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.005	<0.05	0.006	0.003	<0.05	-	-
Lab	17	0.020	0.020	0.024	0.028	0.021	0.023	0.003
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.003	0.009	0.009	0.004	0.004	0.006	0.003
Lab	20	0.008	0.007					
Lab	21	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	24	<0.016	<0.009	<0.011	<0.005	<0.048	-	-
Lab	25	0.005	0.005	0.005	0.005	0.01[D]	0.005	0.000
Lab	26	0.008	0.005	0.006	0.006	0.012	0.007	0.003
Lab	27	0.0240	0.0242	0.0240	0.0237	0.0246	0.0241	0.0003
Lab	28	0.019	0.014	0.013	0.019	0.015	0.016	0.003
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	0.023	0.019	0.028	0.024	0.025	0.024	0.003
Lab	31	0.015	0.012					
Lab	32	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	33	0.001	<0.001	<0.001	0.001	<0.001	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	36	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.00323	0.00381	0.00372	0.00358	0.00348	0.00356	0.00023
Lab	38	0.00382	0.00341	0.00331	0.00335	0.00333	0.00344	0.00022

Copper

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.011	0.011	0.011	0.011	0.011	0.011	0.000
Lab	2	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	3	0.013	0.014	0.013	0.013	0.014	0.013	0.001
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1*	0.0
Lab	5	0.0204	0.0304[D]	0.0213	0.0215	0.0211	0.0211	0.0005
Lab	6	0.013	0.013	0.016	0.014	0.014	0.014	0.001
Lab	7	0.060	0.080	0.030	0.040	0.030	0.048*	0.022
Lab	8	0.035	0.037	0.033	0.033	0.037	0.045	0.002
Lab	9	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Lab	10	0.03	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	0.018	0.016	0.018	0.016	0.016	0.017	0.001
Lab	12	0.01	0.02	0.01	0.01	0.01	0.01	0.00
Lab	13	0.0120	0.0115	0.0120	0.0135	0.0130	0.0124	0.0008
Lab	14	0.014	0.015	0.015	0.014	0.014	0.014	0.001
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.013	0.005	0.013	0.011	0.012	0.011	0.003
Lab	17	0.024	0.023	0.023	0.026	0.018	0.023	0.003
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.017	0.020	0.019	0.015	0.020	0.018	0.002
Lab	20	0.015	0.020					
Lab	21	0.01	0.01	0.01	0.01	<0.01	0.01	0.00
Lab	22	0.0119	0.0131	0.0133	0.0144	0.0123	0.0130	0.0010
Lab	23	0.008	0.009	0.010	0.008	0.007	0.008	0.001
Lab	24	<0.037	<0.023	<0.017	<0.008	<0.011	-	-
Lab	25	0.015	0.01	0.01	0.01	0.01	0.011	0.002
Lab	26	0.015	0.014	0.015	0.015	0.013	0.014	0.001
Lab	27	0.0480	0.0477	0.0488	0.0474	0.0473	0.0478*	0.0006
Lab	28	0.021	0.019	0.020	0.021	0.019	0.020	0.001
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	0.023	0.022	0.027	0.022	0.019	0.023	0.003
Lab	31	0.028	0.020					
Lab	32	0.005	0.008	0.005	0.010	0.005	0.007	0.002
Lab	33	0.0117[D]	0.0107	0.0104	0.0100	0.0107	0.0105	0.0003
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	36	0.008	0.008	0.008	0.008	0.008	0.008	0.000
Lab	37	0.0108	0.0104	0.0110	0.0106	0.0106	0.0107	0.0002
Lab	38	0.0122	0.0117	0.0119	0.0125	0.0119	0.0120	0.0003

Copper

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	0.073	0.076	0.074	0.076	0.073	0.074	0.002
Lab	2	0.10	0.09	0.09	0.10	0.09	0.09	0.01
Lab	3	0.094	0.092	0.090	0.090	0.090	0.091	0.002
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Lab	5	0.118	0.117	0.113	0.126	0.118	0.118	0.005
Lab	6	0.084	0.081	0.085	0.085	0.086	0.084	0.002
Lab	7	0.120	0.110	0.110	0.110	0.120	0.114	0.005
Lab	8	0.093	0.092	0.095	0.095	0.096	0.094	0.002
Lab	9	0.09	0.09	0.09	0.09	0.09	0.09	0.00
Lab	10	0.11	0.13	0.13	0.12	0.11	0.12	0.01
Lab	11	0.083	0.081	0.085	0.081	0.083	0.083	0.002
Lab	12	0.08	0.08	0.07	0.07	0.06	0.07	0.01
Lab	13	0.0810	0.0805	0.0855	0.0880	0.0855	0.0841	0.0032
Lab	14	0.084	0.088	0.085	0.084	0.083	0.085	0.002
Lab	15	0.04	0.04	0.04	0.04	0.04	0.04*	0.00
Lab	16	0.078	0.062	0.073	0.069	0.062	0.069	0.007
Lab	17	0.154	0.159	0.149	0.160	0.160	0.156*	0.005
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.089	0.096	0.091	0.092	0.087	0.091	0.003
Lab	20	0.085	0.084					
Lab	21	0.07	0.07	0.07	0.07	0.07	0.07	0.00
Lab	22	0.0935	0.0880	0.0910	0.0889	0.0859	0.0895	0.0029
Lab	23	0.112	0.111	0.113	0.112	0.110	0.112	0.001
Lab	24	0.14	0.14	0.094	0.13	<0.043	0.12	0.02
Lab	25	0.05	0.05	0.045	0.05	0.045	0.048	0.003
Lab	26	0.086	0.085	0.085	0.083	0.084	0.085	0.001
Lab	27	0.0937	0.0804	0.0900	0.0866	0.0904	0.0882	0.0050
Lab	28	0.095	0.095	0.095	0.094	0.098	0.095	0.002
Lab	29	0.04	0.04	0.04	0.04	0.03	0.04*	0.00
Lab	30	0.157	0.154	0.148	0.162	0.155	0.155*	0.005
Lab	31	0.117	0.089					
Lab	32	0.100	0.092	0.096	0.097	0.095	0.096	0.003
Lab	33	0.0897	0.0894	0.0905	0.0898	0.0897	0.0898	0.0004
Lab	34	0.08	0.08	0.08	0.08	0.08	0.08	0.00
Lab	35	0.089	0.091	0.096	0.092	0.115[D]	0.092	0.003
Lab	36	0.065[D]	0.072	0.072	0.072	0.072	0.072	0.000
Lab	37	0.0844	0.0826	0.0846	0.0832	0.0837	0.0837	0.0008
Lab	38	0.0921	0.0887	0.0822	0.0875	0.0862	0.0873	0.0036

Copper

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.171	0.166	0.162	0.170	0.162	0.166	0.004
Lab	2	0.23[D]	0.20	0.20	0.20	0.20	0.20	0.00
Lab	3	0.2	0.19	0.19	0.2	0.2	0.20	0.01
Lab	4	0.3	0.3	0.3	0.3	0.3	0.3*	0.0
Lab	5	0.229	0.236	0.241	0.232	0.224	0.232	0.007
Lab	6	0.186	0.185	0.185	0.183	0.186	0.185	0.001
Lab	7	0.230	0.230	0.220	0.210	0.220	0.222	0.008
Lab	8	0.209	0.210	0.205	0.222	0.203	0.210	0.007
Lab	9	0.20	0.20	0.20	0.20	0.20	0.20	0.00
Lab	10	0.22	0.25	0.25	0.23	0.23	0.24	0.01
Lab	11	0.186	0.182	0.181	0.184	0.184	0.183	0.002
Lab	12	0.17	0.18	0.19	0.18	0.19	0.18	0.01
Lab	13	0.1790	0.1800	0.1890	0.1935	0.1925	0.187	0.007
Lab	14	0.18	0.20	0.19	0.19	0.19	0.19	0.01
Lab	15	0.15	0.15	0.15	0.15	0.14	0.15	0.00
Lab	16	0.18	0.15	0.16	0.15	0.15	0.16	0.01
Lab	17	0.326	0.330	0.319	0.324	0.324	0.325*	0.004
Lab	18	0.16	0.18	0.15	0.17	0.17	0.17	0.01
Lab	19	0.212	0.200	0.206	0.208	0.202	0.206	0.005
Lab	20	0.185	0.180					
Lab	21	0.16	0.16	0.16	0.16	0.17	0.16	0.00
Lab	22	0.216	0.195	0.205	0.197	0.206	0.204	0.008
Lab	23	0.220	0.222	0.227	0.198	0.200	0.213	0.013
Lab	24	0.17	0.28	0.16	0.26	0.15	0.20	0.06
Lab	25	0.2	0.2	0.2	0.2	0.2	0.2	0.0
Lab	26	0.185	0.187	0.192	0.183	0.187	0.187	0.003
Lab	27	0.187	0.166	0.196	0.187	0.191	0.185	0.011
Lab	28	0.198	0.203	0.204	0.200	0.197	0.200	0.003
Lab	29	0.15	0.15	0.15	0.15	0.14	0.15	0.00
Lab	30	0.325	0.331	0.318	0.328	0.320	0.324*	0.005
Lab	31	0.228	0.200					
Lab	32	0.214	0.208	0.214	0.207	0.208	0.210	0.003
Lab	33	0.208	0.208	0.209	0.206	0.212	0.209	0.002
Lab	34	0.20	0.19	0.20	0.20	0.19	0.20	0.01
Lab	35	0.216	0.222	0.223	0.224	0.248	0.227	0.012
Lab	36	0.17	0.15	0.16	0.17	0.17	0.16	0.01
Lab	37	0.184	0.188	0.186	0.189	0.187	0.187	0.002
Lab	38	0.194	0.182	0.190	0.191	0.184	0.188	0.005

Zinc

Sample A
mg/L

							Mean	Standard Deviation
Lab	1	0.0116	0.0118	0.0114	0.0110	0.0123	0.0116	0.0005
Lab	2	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	3	0.013[D]	0.009	0.009	0.009	0.008	0.009	0.001
Lab	4	0	0	0	0	0	-	-
Lab	5	0.0101	0.0103	0.0113	0.0103	0.0111	0.0106	0.0005
Lab	6	0.108	0.109	0.107	0.108	0.109	0.108*	0.001
Lab	7	0.023	0.022	0.029	0.028	0.032	0.027*	0.004
Lab	8	0.024	0.035	0.016	0.016	0.028	0.024*	0.008
Lab	9	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	10	0.01	0.01	<0.01	<0.01	0.01	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12	0.03	0.01	0.02	0.01	0.02	0.02*	0.01
Lab	13	0.0115	0.0120	0.0115	0.0120	0.0120	0.0118	0.0003
Lab	14	0.008	0.009	0.008	0.009	0.009	0.009	0.001
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.024	0.016	0.002	0.014	0.011	0.013	0.008
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	0.02	0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.010	0.010	0.010	0.011	0.011	0.010	0.001
Lab	20	0.012	0.015					
Lab	21	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	22	0.0113	0.0125	0.0213[D]	0.0138	0.0132	0.0124	0.0008
Lab	23	0.06	0.05	0.06	0.07	0.05	0.06*	0.01
Lab	24	0.025	0.020	0.021	0.022	0.026	0.023*	0.003
Lab	25	0.005	0.005	0.005	0.005	<0.005	0.005	0.000
Lab	26	0.009	0.003	0.003	0.006	0.017	0.008	0.006
Lab	27	0.0117	0.0136	0.0135	0.0133	0.0140	0.0132	0.0009
Lab	28	0.015	0.017	0.014	0.017	0.016	0.016	0.001
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31	0.01	0.01					
Lab	32	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	33	0.0107	0.0088	0.0092	0.0085	0.0086	0.0092	0.0009
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	0.013	0.013	0.013	0.013	0.013	0.013	0.000
Lab	37	0.0128	0.0133	0.0139	0.0141	0.0137	0.0135	0.0005
Lab	38	0.0131	0.0119	0.0118	0.0131	0.0122	0.0124	0.0006

Zinc

Sample B
mg/L

							Mean	Standard Deviation
Lab	1	0.0547	0.0537	0.0537	0.0537	0.0545	0.0541	0.0005
Lab	2	0.05	0.06	0.06	0.05	0.05	0.05	0.01
Lab	3	0.057	0.057	0.055	0.056	0.055	0.056	0.001
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1*	0.0
Lab	5	0.0765	0.0776	0.0782	0.0744	0.0822	0.0778*	0.0029
Lab	6	0.054	0.055	0.054	0.054	0.055	0.054	0.001
Lab	7	0.075	0.055	0.059	0.053	0.080	0.064	0.012
Lab	8	0.070	0.097	0.065	0.055	0.070	0.071*	0.016
Lab	9	0.049	0.049	0.048	0.046	0.054	0.049	0.003
Lab	10	0.06	0.06	0.07	0.08	0.06	0.07*	0.01
Lab	11	0.063	0.059	0.063	0.056	0.059	0.060	0.003
Lab	12	0.06	0.11	0.05	0.11	0.06	0.08*	0.03
Lab	13	0.0570	0.0560	0.0575	0.0585	0.0580	0.0574	0.0010
Lab	14	0.049	0.049	0.048	0.050	0.050	0.049	0.001
Lab	15	0.06	0.07	0.05	0.05	0.07	0.06	0.01
Lab	16	0.066	0.040	0.041	0.059	0.060	0.053	0.012
Lab	17	0.055	0.060	0.050	0.056	0.060	0.056	0.004
Lab	18	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Lab	19	0.059	0.062	0.062	0.059	0.059	0.060	0.002
Lab	20	0.057	0.059					
Lab	21	0.05	0.05	0.05	0.05	0.05	0.05	0.00
Lab	22	0.0538	0.0525	0.0550	0.0550	0.0625	0.0558	0.0039
Lab	23	0.11	0.10	0.09	0.13	0.11	0.11*	0.01
Lab	24	0.069	0.070	0.062	0.071	0.061	0.067	0.005
Lab	25	0.04	0.03	0.025	0.025	0.03	0.030*	0.006
Lab	26	0.052	0.053	0.053	0.054	0.050	0.052	0.002
Lab	27	0.0635	0.0587	0.0591	0.0577	0.0590	0.0596	0.0022
Lab	28	0.054	0.054	0.054	0.055	0.054	0.054	0.000
Lab	29	0.06	0.06	0.05	0.05	0.04	0.05	0.01
Lab	30	0.053	0.061	0.050	0.054	0.060	0.056	0.005
Lab	31	0.050	0.048					
Lab	32	0.051	0.052	0.055	0.053	0.052	0.053	0.002
Lab	33	0.058	0.058	0.057	0.058	0.059	0.058	0.001
Lab	34	0.07	0.06	<0.05	<0.05	<0.05	-	-
Lab	35	0.031	0.028	0.032	0.031	0.046	0.034*	0.007
Lab	36	0.060	0.056	0.056	0.056	0.056	0.057	0.002
Lab	37	0.0539	0.0545	0.0565	0.0545	0.0540	0.0547	0.0011
Lab	38	0.059	0.061	0.064	0.066	0.067	0.063	0.003

Zinc

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	0.228	0.236	0.233	0.239	0.231	0.233	0.004
Lab	2	0.25	0.24	0.24	0.23	0.23	0.24	0.01
Lab	3	0.25	0.25	0.25	0.25	0.25	0.25	0.00
Lab	4	0.3	0.3	0.3	0.3	0.3	0.3*	0.0
Lab	5	0.260	0.260	0.260	0.260	0.260	0.260	0.000
Lab	6	0.256	0.263	0.264	0.270	0.264	0.263	0.005
Lab	7	0.239	0.232	0.228	0.234	0.232	0.233	0.004
Lab	8	0.243	0.236	0.234	0.232	0.231	0.235	0.005
Lab	9	0.227	0.243	0.248	0.248	0.248	0.243	0.009
Lab	10	0.28	0.29	0.27	0.32	0.29	0.29*	0.02
Lab	11	0.213	0.209	0.206	0.209	0.209	0.209*	0.002
Lab	12	0.27	0.25	0.25	0.28	0.24	0.26	0.02
Lab	13	0.2450	0.2410	0.2455	0.2490	0.2435	0.245	0.003
Lab	14	0.26	0.25	0.24	0.24	0.24	0.25	0.01
Lab	15	0.26	0.25	0.25	0.24	0.23	0.25	0.01
Lab	16	0.26	0.23	0.22	0.20	0.20	0.22*	0.02
Lab	17	0.258	0.261	0.263	0.249	0.263	0.259	0.006
Lab	18	0.25	0.25	0.24	0.27	0.25	0.25	0.01
Lab	19	0.256	0.252	0.253	0.250	0.250	0.252	0.002
Lab	20	0.248	0.240					
Lab	21	0.21	0.20	0.22	0.20	0.21	0.21*	0.01
Lab	22	0.241	0.245	0.266	0.249	0.237	0.248	0.011
Lab	23	0.30	0.28	0.29	0.32	0.30	0.30*	0.01
Lab	24	0.26	0.25	0.26	0.26	0.24	0.25	0.01
Lab	25	0.14[D]	0.09	0.09	0.09	0.09	0.09*	0.00
Lab	26	0.224	0.232	0.225	0.229	0.221	0.226	0.004
Lab	27	0.236	0.233	0.238	0.232	0.235	0.235	0.002
Lab	28	0.213	0.212	0.215	0.214	0.220	0.215*	0.003
Lab	29	0.26	0.24	0.25	0.26	0.23	0.25	0.01
Lab	30	0.256	0.268	0.265	0.248	0.264	0.260	0.008
Lab	31	0.46	0.43					
Lab	32	0.264	0.260	0.259	0.262	0.263	0.262	0.002
Lab	33	0.260	0.258	0.258	0.260	0.260	0.259	0.001
Lab	34	0.31	0.30	0.29	0.30	0.29	0.30*	0.01
Lab	35	0.257	0.254	0.267	0.260	0.246	0.257	0.008
Lab	36	0.25	0.25	0.25	0.25	0.25	0.25	0.00
Lab	37	0.238	0.235	0.240	0.232	0.239	0.237	0.003
Lab	38	0.260	0.253	0.266	0.259	0.256	0.259	0.005

Zinc

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	1.03	0.999	0.971	1.01	0.972	0.996	0.025
Lab	2	1.01	0.84	0.88	0.89	0.90	0.90*	0.06
Lab	3	1.1	1.1	1.1	1.1	1.1	1.1	0.0
Lab	4	1.1	1.2	1.1	1.2	1.1	1.1	0.1
Lab	5	1.110	1.120	1.120	1.150	1.150	1.13	0.02
Lab	6	1.033	1.042	1.028	1.033	1.040	1.04	0.01
Lab	7	1.100	1.030	1.050	1.020	1.080	1.06	0.04
Lab	8	1.06	1.08	1.03	1.09	1.02	1.06	0.03
Lab	9	1.02	1.02	1.01	1.01	0.995	1.01	0.01
Lab	10	1.14	1.17	1.14	1.26	1.14	1.17	0.05
Lab	11	0.968	0.960	0.968	0.964	0.964	0.965	0.003
Lab	12	1.07	1.07	1.08	1.08	1.11	1.08	0.02
Lab	13	1.055	1.035	1.046	1.065	1.050	1.05	0.01
Lab	14	1.05	1.13	1.08	1.05	1.01	1.06	0.04
Lab	15	1.13	1.05	1.08	1.10	1.06	1.08	0.03
Lab	16	1.0	1.0	0.96	0.91	0.95	0.96	0.04
Lab	17	1.115	1.121	1.109	1.121	1.109	1.12	0.01
Lab	18	1.04	1.11	1.01	1.00	1.08	1.05	0.05
Lab	19	1.132	1.141	1.129	1.118	1.120	1.13	0.01
Lab	20	1.01	1.01					
Lab	21	0.88	0.93	0.89	0.89	0.94	0.91*	0.03
Lab	22	1.12	1.07	1.10	1.08	1.13	1.10	0.03
Lab	23	1.05	1.00	1.10	1.07	1.08	1.06	0.04
Lab	24	1.17	1.13	1.08	1.09	0.98	1.09	0.07
Lab	25	0.54	0.54	0.54	0.54	0.54	0.54*	0.00
Lab	26	0.961	0.977	0.980	0.956	0.954	0.966	0.012
Lab	27	0.963	0.940	0.949	0.954	0.988	0.959	0.018
Lab	28	0.960	0.960	0.961	0.961	0.960	0.960	0.001
Lab	29	1.15	1.06	1.09	1.11	1.07	1.10	0.04
Lab	30	1.113	1.123	1.106	1.124	1.109	1.12	0.01
Lab	31	0.95	0.96					
Lab	32	1.14	1.14	1.14	1.10	1.12	1.13	0.02
Lab	33	1.13	1.13	1.13	1.14	1.13	1.13	0.00
Lab	34	1.08	1.07	1.06	1.11	1.06	1.08	0.02
Lab	35	1.24	1.23	1.23	1.23	1.30	1.25*	0.03
Lab	36	1.0	1.01	1.05	1.05	1.04	1.03	0.02
Lab	37	1.01	1.06	1.02	1.04	1.02	1.03	0.02
Lab	38	1.20	1.20	1.20	1.19	1.18	1.19	0.01

Molybdenum

Sample A
mg/L

							Mean	Standard Deviation
Lab	1	0.0062	0.0037	0.0036	0.0042	0.0029	0.0041	0.0013
Lab	2							
Lab	3	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	4							
Lab	5	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	6	<0.07	<0.07	<0.07	<0.07	<0.07	-	-
Lab	7							
Lab	8	<0.009	<0.09	<0.09	<0.09	<0.09	-	-
Lab	9	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	10	<0.02	<0.02	0.02	<0.02	0.02	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12							
Lab	13	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	14	0.006	0.006	0.006	0.006	0.005	0.006	0.000
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.01	0.03	0.02	<0.5	0.02	0.02	0.01
Lab	17	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	<0.02	<0.02					
Lab	21	<0.007	<0.007	<0.007	<0.007	<0.007	-	-
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.016	<0.016	<0.016	<0.016	<0.016	-	-
Lab	24	<0.009	0.023	<0.015	<0.015	<0.015	-	-
Lab	25	0.03	0.015	0.01	0.005	0.005	0.013	0.010
Lab	26	0.007	0.008	0.008	0.008	0.008	0.008	0.000
Lab	27	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	28	<0.020	0.022	0.020	<0.020	<0.020	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	31							
Lab	32							
Lab	33	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	0.00496	0.00500	0.00507	0.00500	0.00494	0.00499	0.00005
Lab	38	0.0047	0.0040	0.0050	0.0050	0.0044	0.0046	0.0004

Molybdenum

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.0110	0.0124	0.0124	0.0112	0.0114	0.0117	0.0007
Lab	2							
Lab	3	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	4							
Lab	5	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	6	<0.07	<0.07	<0.07	<0.07	<0.07	-	-
Lab	7							
Lab	8	<0.09	<0.09	<0.09	<0.09	<0.09	-	-
Lab	9	0.01	0.01	<0.01	<0.01	<0.01	-	-
Lab	10	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	0.015	0.015	0.015	0.015	0.015	0.015	0.000
Lab	12							
Lab	13	0.014	0.014	0.016	0.016	0.012	0.014	0.002
Lab	14	0.016	0.017	0.017	0.016	0.016	0.016	0.001
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.02	0.03	0.03	0.03	0.04	0.03*	0.01
Lab	17	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	18	<0.01	<0.01	0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	0.02	0.02					
Lab	21	0.011	0.015	0.016	0.014	0.014	0.014	0.002
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.016	<0.016	<0.016	<0.016	<0.016	-	-
Lab	24	0.018	0.029	<0.008	<0.015	<0.011	-	-
Lab	25	0.015	0.035[D]	0.015	0.015	0.015	0.015	0.000
Lab	26	0.017	0.013	0.013	0.013	0.013	0.014	0.002
Lab	27	0.0116	0.0110	0.0113	0.0114	0.0115	0.0114	0.0002
Lab	28	0.024	0.028	0.028	0.030	0.028	0.028	0.002
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	31							
Lab	32							
Lab	33	0.0143	0.0187	0.0172	0.0116	0.0168	0.0157	0.0028
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	0.0144	0.0144	0.0150	0.0143	0.0145	0.0145	0.0003
Lab	38	0.0119	0.0121	0.0109	0.0119	0.0138	0.0121	0.0011

Molybdenum

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	0.0181	0.0170	0.0190	0.0188	0.0193	0.0184	0.0009
Lab	2							
Lab	3	0.03	0.02	0.03	0.03	0.03	0.03	0.00
Lab	4							
Lab	5	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	6	<0.07	<0.07	<0.07	<0.07	<0.07	-	-
Lab	7							
Lab	8	<0.09	<0.09	<0.09	<0.09	<0.09	-	-
Lab	9	0.03	0.02	0.02	0.03	0.03	0.03	0.01
Lab	10	<0.02	0.1	<0.02	0.06	<0.02	-	-
Lab	11	0.022	0.022	0.022	0.030	0.030	0.025	0.004
Lab	12							
Lab	13	0.022	0.020	0.022	0.022	0.022	0.022	0.001
Lab	14	0.028	0.024	0.021	0.028	0.018	0.024	0.004
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.04	0.06	0.04	0.04	0.05	0.05*	0.01
Lab	17	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20	0.04	0.04					
Lab	21	0.021	0.019	0.020	0.018	0.019	0.019	0.001
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.016	<0.016	<0.016	<0.016	<0.016	-	-
Lab	24	0.023	0.030	0.025	0.018	0.022	0.024	0.004
Lab	25	0.03	0.03	0.025	0.02	0.025	0.026	0.004
Lab	26	0.027	0.030	0.026	0.027	0.027	0.027	0.002
Lab	27	0.0207	0.0210	0.0213	0.0206	0.0205	0.0208	0.0003
Lab	28	0.026	0.038	0.040	0.032	0.035	0.034	0.005
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	31							
Lab	32							
Lab	33	0.0270	0.0258	0.0246	0.0282	0.0229	0.0257	0.0021
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	0.005	0.005	0.005	0.005	0.005	0.005*	0.000
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	0.0226	0.0226	0.0229	0.0222	0.0223	0.0225	0.0003
Lab	38	0.0214	0.0203	0.0235	0.0219	0.0243	0.0223	0.0016

Molybdenum

Sample D
mg/L

							Mean	Standard Deviation
Lab	1	0.0282	0.0291	0.0287	0.0296	0.0295	0.0290	0.0006
Lab	2							
Lab	3	0.04	0.04	0.04	0.04	0.04	0.04	0.00
Lab	4							
Lab	5	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	6	<0.07	<0.07	<0.07	<0.07	<0.07	-	-
Lab	7							
Lab	8	<0.09	<0.09	<0.09	<0.09	<0.09	-	-
Lab	9	0.03	0.04	0.04	0.03	0.04	0.04	0.01
Lab	10	<0.02	0.09	0.07	0.05	<0.02	-	-
Lab	11	0.037	0.045	0.030	0.045	0.045	0.040	0.007
Lab	12							
Lab	13	0.032	0.034	0.036	0.036	0.034	0.034	0.002
Lab	14	0.040	0.032	0.034	0.031	0.030	0.033	0.004
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.07	0.09	0.07	0.06	0.07	0.07*	0.01
Lab	17	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	18	0.03	0.04	0.03	0.03	0.03	0.03	0.00
Lab	19							
Lab	20	0.07	0.08					
Lab	21	0.032	0.030	0.031	0.033	0.034	0.032	0.002
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.016	<0.016	<0.016	<0.016	<0.016	-	-
Lab	24	0.032	0.047	0.034	0.028	0.028	0.034	0.008
Lab	25	0.03	0.04	0.035	0.04	0.035	0.036	0.004
Lab	26	0.040	0.038	0.043	0.038	0.040	0.040	0.002
Lab	27	0.292	0.296	0.294	0.290	0.291	0.293*	0.002
Lab	28	0.052	0.044	0.044	0.048	0.046	0.047	0.003
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.2	<0.2	<0.2	<0.2	<0.2	-	-
Lab	31							
Lab	32							
Lab	33	0.034	0.036	0.032	0.039	0.036	0.035	0.003
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	0.020	0.025	0.021	0.018	0.028	0.022*	0.004
Lab	36	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	37	0.0353	0.0355	0.0356	0.0356	0.0358	0.0356	0.0002
Lab	38	0.0381	0.0382	0.0379	0.0384	0.0383	0.0381	0.0002

Silver

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	-	-
Lab	2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	3	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5							
Lab	6							
Lab	7	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Lab	8	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	9	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12	<0.01	0.01	<0.01	0.01	0.01	-	-
Lab	13	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	14	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	<0.1	<0.1	0.003	<0.1	0.001	-	-
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	20	<0.02	0.001					
Lab	21	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	24	<0.007	0.033	0.018	<0.015	<0.015	-	-
Lab	25	0.01	0.005	<0.005	<0.005	0.01	-	-
Lab	26							
Lab	27	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	28	<0.007	<0.007	<0.007	<0.007	<0.007	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31							
Lab	32							
Lab	33	0.018	0.019	0.015	0.016	0.017	0.017	0.002
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	0.007	0.007	<0.005	0.007	0.007	0.007	0.000
Lab	37	0.000073	0.000044	0.000073	0.000075	0.000045	0.000062	0.000016
Lab	38	0.000052	0.000074	0.000070	0.000066	0.000066	0.000066	0.000008

Silver

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	<0.0019	0.0028	<0.0019	0.0022	<0.0019	-	-
Lab	2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	3	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5							
Lab	6							
Lab	7	0.00202	0.00182	0.00206	0.00197	0.00214	0.00200	0.00012
Lab	8	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	9	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Lab	13	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	14	0.0013	0.0017	0.0018	0.0016	0.0016	0.0016	0.0002
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	<0.1	0.001	0.002	0.002	0.003	0.002	0.001
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	20	<0.02	0.004					
Lab	21	<0.005	0.006	<0.005	<0.005	<0.005	-	-
Lab	22	<0.0125	<0.0125	<0.0125	<0.0125	<0.0125	-	-
Lab	23	0.002	0.002	0.003	0.002	0.003	0.002	0.001
Lab	24	<0.014	0.036	<0.015	<0.015	<0.007	-	-
Lab	25	0.005	<0.005	0.005	<0.005	0.004	-	-
Lab	26							
Lab	27	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	28	<0.007	<0.007	<0.007	<0.007	<0.007	-	-
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31							
Lab	32							
Lab	33	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	0.005	0.005	<0.005	<0.005	<0.005	-	-
Lab	37	0.00263	0.00208	0.00210	0.00211	0.00230	0.00224	0.00023
Lab	38	0.00213	0.00218	0.00224	0.00219	0.00224	0.00220	0.00005

Silver

Sample C

mg/L

							Mean	Standard Deviation
Lab	1	0.0056	0.0068	0.0080	0.0063	0.0063	0.0066	0.0009
Lab	2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	3	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	4	0.8	0.8	0.8	0.8	0.8	0.8*	0.0
Lab	5							
Lab	6							
Lab	7	0.00660	0.00686	0.00651	0.00654	0.00690	0.00668	0.00018
Lab	8	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	9	0.010	0.008	0.008	0.010	0.010	0.009	0.001
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12	0.02	0.02	0.02	0.02	0.02	0.02*	0.00
Lab	13	0.0030	0.0020	0.0028	0.0016	0.0012	0.0021	0.0008
Lab	14	0.0051	0.0057	0.0055	0.0055	0.0054	0.0054	0.0002
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.003	0.004	0.007	0.007	0.005	0.005	0.002
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.0052	0.0052	0.0052	0.0052	0.0052	0.0052	0.0000
Lab	20	0.008	0.009					
Lab	21	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	22	0.0223	0.0179	0.0169	0.0169	0.0189	0.0186*	0.0022
Lab	23	0.005	0.004	0.006	0.005	0.004	0.005	0.001
Lab	24	<0.015	0.036	0.024	<0.015	<0.015	-	-
Lab	25	0.005	<0.005	0.005	0.005	0.004	0.005	0.001
Lab	26							
Lab	27	0.00600	0.00610	0.00585	0.00600	0.00592	0.00597	0.00009
Lab	28	0.008	0.008	0.008	0.008	0.008	0.008	0.000
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31							
Lab	32							
Lab	33	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	0.013	0.007	0.013	0.007	0.013	0.011*	0.003
Lab	37	0.00689	0.00706	0.00715	0.00708	0.00706	0.00704	0.00010
Lab	38	0.00683	0.00680	0.00717	0.00616	0.00651	0.00669	0.00037

Silver

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.0085	0.0087	0.0090	0.0097	0.0082	0.00882	0.00057
Lab	2	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Lab	3	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1*	0.0
Lab	5							
Lab	6							
Lab	7	0.00822	0.00840	0.00809	0.00835	0.00854	0.00832	0.00017
Lab	8	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	9	0.013	0.013	0.011	0.012	0.013	0.012	0.001
Lab	10	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	11							
Lab	12	0.03	0.03	0.03	0.03	0.03	0.03*	0.00
Lab	13	0.0044	0.0036	0.0030	0.0028	0.0036	0.0035	0.0006
Lab	14	0.0073	0.0074	0.0073	0.0078	0.0078	0.0075	0.0003
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	0.006	0.007	0.006	0.007	0.009	0.007	0.001
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096	0.0000
Lab	20	0.016	0.014					
Lab	21	0.007	0.006	0.005	<0.005	<0.005	-	-
Lab	22	0.0283	0.0211	0.0208	0.0211	0.0235	0.0230*	0.0032
Lab	23	0.010	0.009	0.008	0.011	0.013	0.010	0.002
Lab	24	<0.010	0.041	0.019	<0.008	0.018	-	-
Lab	25	0.015	0.015	0.005	0.01	0.01	0.011	0.004
Lab	26							
Lab	27	0.00800	0.00830	0.00820	0.00840	0.00820	0.00822	0.00015
Lab	28	0.012	0.012	0.012	0.014	0.012	0.012	0.001
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31							
Lab	32							
Lab	33	0.037	0.032	0.033	0.033	0.030	0.033*	0.003
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	36	0.013	0.013	0.013	0.013	0.013	0.013	0.000
Lab	37	0.00892	0.00908	0.00907	0.00951	0.00921	0.00916	0.00022
Lab	38	0.00842	0.00873	0.00831	0.00848	0.00870	0.00853	0.00018

Cadmium

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	0.0015	<0.0011	<0.0011	<0.0011	0.0014	-	-
Lab	2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	3	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000
Lab	6	0.004	0.003	0.003	0.003	0.004	0.003	0.001
Lab	7	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	8	0.001	0	0.001	0.001	0.002	0.001	0.001
Lab	9	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	10	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	11	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	-
Lab	12	0.01	0.01	<0.01	<0.01	<0.01	-	-
Lab	13	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	14	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	<0.010	<0.010	0.003	0.001	0.001	-	-
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	-	-
Lab	20	0.002	0.002					
Lab	21	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	22	0.00250	0.00250	0.00250	0.00250	0.00295	0.00259	0.00020
Lab	23	<0.006	<0.006	<0.006	<0.006	<0.006	-	-
Lab	24	<0.003	<0.003	<0.003	0.003	<0.003	-	-
Lab	25	0.005	<0.005	0.015	<0.005	0.002	-	-
Lab	26	0.003	0.003	0.003	0.004	0.003	0.003	0.000
Lab	27	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	28	0.002	0.002	0.002	0.002	0.002	0.002	0.000
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31	<0.002	<0.002					
Lab	32	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	33	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	34	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	0.007	0.007	0.007	0.007	0.007	0.007	0.000
Lab	37	0.000040	0.000044	0.000042	0.000040	0.000045	0.000042	0.000002
Lab	38	0.000023	0.000022	0.000024	0.000023	0.000023	0.000023	0.000001

Cadmium

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	0.0030	0.0028	0.0031	0.0021	0.0021	0.0026	0.0005
Lab	2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	3	0.003	0.003	0.004	<0.002	0.002	0.003	0.001
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1*	0.0
Lab	5	0.0023	0.0024	0.0023	0.0024	0.0025	0.0024	0.0001
Lab	6	0.004	0.003	0.002	0.001	0.001	0.002	0.001
Lab	7	0.00241	0.00252	0.00247	0.00238	0.00249	0.00245	0.00006
Lab	8	0.001	0.001	0.003	0.000	0.001	0.001	0.001
Lab	9	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	10	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	11	0.0044	0.0044	0.0045	0.0044	0.0044	0.0044	0.0000
Lab	12	0.01	0.01	0.01	0.01	0.01	0.01*	0.00
Lab	13	0.0018	0.0026	0.0016	0.0026	0.0030	0.0023	0.0006
Lab	14	0.0019	0.0022	0.0021	0.0016	0.0023	0.0020	0.0003
Lab	15	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	16	<0.010	0.001	0.001	0.004	0.003	0.002	0.002
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19	0.001	0.002	0.001	0.002	0.001	0.001	0.001
Lab	20	0.002	0.002					
Lab	21	<0.002	0.003	0.002	0.002	0.002	0.002	0.001
Lab	22	0.00500	0.00375	0.00500	0.00375	0.00469	0.00444*	0.00064
Lab	23	0.010	0.011	0.012	0.009	0.010	0.010*	0.001
Lab	24	<0.003	<0.003	<0.003	<0.003	0.003	-	-
Lab	25	0.005	0.005	<0.005	0.005	0.004	0.005*	0.001
Lab	26	0.004	0.004	0.005	0.006	0.005	0.005*	0.001
Lab	27	0.0020	0.0026	0.0020	0.0018	0.0018	0.0020	0.0003
Lab	28	0.003	0.003	0.003	0.003	0.003	0.003	0.000
Lab	29	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31	<0.002	<0.002					
Lab	32	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	33	0.0020	0.0010	0.0028	0.0013	0.0028	0.0020	0.0008
Lab	34	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	0.012	0.012	0.012	0.012	0.012	0.012*	0.000
Lab	37	0.00194	0.00195	0.00192	0.00183[D]	0.00195	0.00194	0.00001
Lab	38	0.00234	0.00236	0.00238	0.00238	0.00242	0.00238	0.00003

Cadmium

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	0.0110	0.0096	0.0104	0.0115	0.0098	0.0105	0.0008
Lab	2	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Lab	3	0.015	0.012	0.012	0.011	0.013	0.013	0.002
Lab	4	0.1	0.1	0.1	0.1	0.1	0.1*	0.0
Lab	5	0.0187	0.0177	0.0181	0.0181	0.0177	0.0181	0.0004
Lab	6	0.011	0.011	0.010	0.011	0.010	0.011	0.001
Lab	7	0.020	0.010	0.010	0.020	0.010	0.014	0.005
Lab	8	0.008	0.006	0.008	0.010	0.008	0.008	0.001
Lab	9	0.012	0.013	0.012	0.011	0.013	0.012	0.001
Lab	10	<0.005	0.022	0.021	<0.005	0.009	-	-
Lab	11	0.0105	0.0105	0.0105	0.0105	0.0105	0.0105	0.0000
Lab	12	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	13	0.0108	0.0104	0.0100	0.0112	0.0114	0.0108	0.0006
Lab	14	0.014	0.014	0.012	0.011	0.012	0.013	0.001
Lab	15	0.02	0.02	<0.01	0.02	0.02	0.02	0.00
Lab	16	0.016	0.013	0.014	0.017	0.017	0.015	0.002
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Lab	19	0.015	0.012	0.015	0.012	0.015	0.014	0.002
Lab	20	0.012	0.012					
Lab	21	0.003	0.006	0.004	0.004	0.004	0.004	0.001
Lab	22	0.0138	0.0138	0.0138	0.0138	0.0128	0.0136	0.0004
Lab	23	0.022	0.018	0.020	0.021	0.019	0.020	0.002
Lab	24	0.010	0.008	0.010	0.008	0.009	0.009	0.001
Lab	25	0.01	0.01	0.01	0.005	0.01	0.009	0.002
Lab	26	0.014	0.013	0.013	0.013	0.014	0.013	0.001
Lab	27	0.0110	0.0112	0.0117	0.0112	0.0106	0.0111	0.0004
Lab	28	0.014	0.014	0.014	0.013	0.013	0.014	0.001
Lab	29	0.02	0.02	<0.01	0.02	0.02	0.02	0.00
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31	0.007	0.005					
Lab	32	0.011	0.011	0.011	0.011	0.011	0.011	0.000
Lab	33	0.0098	0.0079	0.0098	0.0134	0.0073	0.0096	0.0023
Lab	34	<0.005	<0.005	<0.005	0.009	0.008	-	-
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	0.020	0.018	0.018	0.020	0.018	0.019	0.001
Lab	37	0.0116	0.0113	0.0115	0.0113	0.0111	0.0114	0.0002
Lab	38	0.0123	0.0129	0.0129	0.0135	0.0129	0.0129	0.0004

Cadmium

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.0176	0.0185	0.0167	0.0177	0.0168	0.0175	0.0007
Lab	2	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	3	0.018	0.019	0.019	0.020	0.018	0.019	0.001
Lab	4	0.1	0	0.1	0.1	0	0.1*	0.1
Lab	5	0.0252	0.0269	0.0255	0.0261	0.0254	0.0258*	0.0007
Lab	6	0.019	0.019	0.017	0.017	0.016	0.018	0.001
Lab	7	0.030	0.020	0.020	0.030	0.020	0.024	0.005
Lab	8	0.013	0.012	0.016	0.016	0.015	0.014*	0.002
Lab	9	0.022	0.022	0.022	0.022	0.023	0.022	0.000
Lab	10	0.023	0.034	0.028	0.032	0.034	0.034*	0.005
Lab	11	0.0200	0.0200	0.0193	0.0200	0.0200	0.0199	0.0003
Lab	12	0.02	0.03	0.03	0.03	0.03	0.03*	0.00
Lab	13	0.0184	0.0176	0.0182	0.0188	0.0190	0.0184	0.0005
Lab	14	0.022	0.020	0.020	0.021	0.018	0.020	0.001
Lab	15	0.03	0.01[D]	0.03	0.03	0.03	0.03*	0.01
Lab	16	0.024	0.025	0.023	0.025	0.026	0.025*	0.001
Lab	17	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	18	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Lab	19	0.021	0.018	0.024	0.021	0.021	0.021	0.002
Lab	20	0.021	0.020					
Lab	21	0.004	0.008	0.009	0.009	0.008	0.008*	0.002
Lab	22	0.0225	0.0213	0.0225	0.0225	0.0231	0.0224	0.0007
Lab	23	0.030	0.028	0.029	0.033	0.030	0.030*	0.002
Lab	24	0.016	0.011	0.015	0.014	0.020	0.015*	0.003
Lab	25	0.01	0.01	0.01	0.01	0.02	0.01*	0.00
Lab	26	0.022	0.022	0.022	0.022	0.020	0.022	0.001
Lab	27	0.0200	0.0184	0.0189	0.0175	0.0179	0.0185	0.0010
Lab	28	0.021	0.020	0.021	0.022	0.020	0.021	0.001
Lab	29	0.02	0.02	<0.01	0.02	0.02	0.02	0.00
Lab	30	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	31	0.016	0.020					
Lab	32	0.020	0.019	0.019	0.019	0.019	0.019	0.000
Lab	33	0.022	0.018	0.020	0.020	0.016	0.019	0.002
Lab	34	0.010	0.006	0.007	0.008	0.006	0.007*	0.002
Lab	35	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	36	0.11	0.13	0.13	0.11	0.12	0.12*	0.01
Lab	37	0.0191	0.0193	0.0192	0.0189	0.0191	0.0191	0.0002
Lab	38	0.0216	0.0223	0.0227	0.0226	0.0206	0.0220	0.0009

Thallium

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	<0.018	<0.018	<0.018	<0.018	<0.018	-	-
Lab	2							
Lab	3	<0.06	<0.06	<0.06	<0.06	<0.06	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	9	0.05	0.03	0.05	0.05	0.03	0.04	0.01
Lab	10	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	11							
Lab	12							
Lab	13	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	14	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	15	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	16							
Lab	17	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20							
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	24	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	28	<0.030	<0.030	<0.030	<0.030	<0.030	-	-
Lab	29	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	30	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	31							
Lab	32	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	33							
Lab	34	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	35	<0.090	<0.090	<0.090	<0.090	<0.090	-	-
Lab	36							
Lab	37	0.0000051	0.0000052	0.0000042	0.0000053	0.0000055	0.0000001	0.00000005
Lab	38	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005		

Thallium

Sample B

mg/L

							Mean	Standard Deviation
Lab	1	<0.018	<0.018	<0.018	<0.018	<0.018	-	-
Lab	2							
Lab	3	<0.06	<0.06	<0.06	<0.06	<0.06	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	9	0.04	0.04	0.04	0.05	0.04	0.04	0.00
Lab	10	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	11							
Lab	12							
Lab	13	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	14	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	15	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	16							
Lab	17	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20							
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	24	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	28	<0.030	0.032	0.030	0.030	<0.030	-	-
Lab	29	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	30	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	31							
Lab	32	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	33							
Lab	34	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	35	<0.090	<0.090	<0.090	<0.090	<0.090	-	-
Lab	36							
Lab	37	0.00093	0.00125	0.00131	0.00129	0.00124	0.00128	0.00003
Lab	38	0.00102	0.00106	0.00102	0.00088	0.00095	0.00099	0.00007

Thallium

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	<0.018	<0.018	<0.018	<0.018	<0.018	-	-
Lab	2							
Lab	3	<0.06	<0.06	<0.06	<0.06	<0.06	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	9	0.06	0.04	0.05	0.05	0.04	0.05	0.01
Lab	10	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	11							
Lab	12							
Lab	13	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	14	0.004	0.005	0.004	0.005	0.005	0.005	0.001
Lab	15	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	16							
Lab	17	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20							
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	24	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	28	0.030	0.034	<0.030	0.030	0.030	0.031	0.002
Lab	29	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	30	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	31							
Lab	32	0.021	0.022	0.022	0.019	0.024	0.022	0.002
Lab	33							
Lab	34	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Lab	35	<0.090	<0.090	<0.090	<0.090	<0.090	-	-
Lab	36							
Lab	37	0.00518	0.00526	0.00535	0.00517	0.00519	0.00523	0.00008
Lab	38	0.00537	0.00523	0.00526	0.00559	0.00536	0.00536	0.00014

Thallium

Sample D
mg/L

							Mean	Standard Deviation
Lab	1	<0.018	<0.018	<0.018	<0.018	<0.018	-	-
Lab	2							
Lab	3	<0.06	<0.06	<0.06	<0.06	<0.06	-	-
Lab	4							
Lab	5							
Lab	6							
Lab	7							
Lab	8	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	9	0.06	0.04	0.05	0.05	0.05	0.05	0.01
Lab	10	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	11							
Lab	12							
Lab	13	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	14	0.008	0.009	0.009	0.008	0.009	0.009	0.001
Lab	15	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	16							
Lab	17	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	18	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	19							
Lab	20							
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	<0.0625	<0.0625	<0.0625	<0.0625	<0.0625	-	-
Lab	23	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Lab	24	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26							
Lab	27	<0.100	<0.100	<0.100	<0.100	<0.100	-	-
Lab	28	<0.030	<0.030	0.030	<0.030	0.034	-	-
Lab	29	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	30	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
Lab	31							
Lab	32	0.080	0.071	0.078	0.068	0.073	0.074	0.005
Lab	33							
Lab	34	0.009	0.010	0.008	0.010	0.012	0.010	0.001
Lab	35	<0.090	<0.090	<0.090	<0.090	<0.090	-	-
Lab	36							
Lab	37	0.0104	0.0103	0.0104	0.0107	0.0104	0.0104	0.0001
Lab	38	0.0111	0.0111	0.0109	0.0108	0.0114	0.0111	0.0002

Lead

Sample A

mg/L

							Mean	Standard Deviation
Lab	1	<0.017	<0.017	<0.017	<0.017	<0.017	-	-
Lab	2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	4	0	0	0	0	0	-	-
Lab	5	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Lab	6	0.022	0.019	0.015	0.028	0.030	0.023	0.006
Lab	7	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Lab	8	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	9	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	10	0.26	<0.02	<0.02	<0.02	<0.02	-	-
Lab	11	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	12	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Lab	13	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Lab	14	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	15	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	16	<0.10	<0.10	0.005	<0.10	0.012	-	-
Lab	17	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	18	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	19	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Lab	20	0.02	0.019					
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	<0.025	<0.025	<0.025	<0.025	<0.025	-	-
Lab	23	0.002	0.002	0.003	0.002	0.002	0.002	0.000
Lab	24	<0.028	<0.030	<0.027	<0.025	<0.048	-	-
Lab	25	<0.005	<0.005	<0.005	<0.005	<0.005	-	-
Lab	26	0.015	0.007	0.011	0.006	0.015	0.011	0.004
Lab	27	<0.020	<0.020	<0.020	<0.020	<0.020	-	-
Lab	28	<0.021	<0.021	<0.021	<0.021	<0.021	-	-
Lab	29	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	30	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	31	<0.01	<0.01					
Lab	32	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	33	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.030	<0.030	<0.030	<0.030	<0.030	-	-
Lab	36	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	37	0.000178	0.000168	0.000172	0.000165	0.000160	0.000169	0.000007
Lab	38	0.00022	0.00022	0.00020	0.00025	0.00019	0.00021	0.00002

Lead

Sample B
mg/L

							Mean	Standard Deviation
Lab	1	0.033	0.029	0.021	0.018	<0.017	0.025	0.007
Lab	2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	0.03	0.02	0.02	0.03	0.03	0.03	0.01
Lab	4	0	0	0	0	0	-	-
Lab	5	0.0250	0.0239	0.0238	0.0242	0.0241	0.0242	0.0005
Lab	6	0.039	0.040	0.038	0.047	0.042	0.041	0.004
Lab	7	0.01845	0.01732	0.01773	0.01755	0.01771	0.0178	0.0004
Lab	8	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	9	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	10	<0.02	0.02	<0.02	<0.02	<0.02	-	-
Lab	11	0.021	0.021	0.021	0.021	0.021	0.021	0.000
Lab	12	0.04	0.03	0.03	0.03	0.03	0.03	0.00
Lab	13	0.034	0.028	0.024	0.030	0.026	0.028	0.004
Lab	14	0.027	0.026	0.030	0.027	0.024	0.027	0.002
Lab	15	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	16	0.021	0.011	0.028	0.021	0.025	0.021	0.006
Lab	17	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	18	0.03	<0.03	<0.03	<0.03	0.03	-	-
Lab	19	0.025	0.025	0.025	0.025	0.05[D]	0.025	0.000
Lab	20	0.04	0.032					
Lab	21	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	22	0.0225	0.0250	0.0238	0.0250	0.0219	0.0236	0.0014
Lab	23	0.022	0.021	0.022	0.020	0.024	0.022	0.001
Lab	24	0.048	0.065	<0.038	<0.041	<0.037	-	-
Lab	25	0.005	0.01	<0.005	<0.005	<0.005	-	-
Lab	26	0.032	0.035	0.038	0.040	0.035	0.036	0.003
Lab	27	0.0216	0.0227	0.0200	0.0253	0.0202	0.0220	0.0022
Lab	28	0.044	0.048	0.048	0.046	0.046	0.046*	0.002
Lab	29	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	30	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	31	0.02	0.03					
Lab	32	0.037	0.034	0.030	0.048	0.032	0.036	0.007
Lab	33	0.0074	0.0069	0.0081	0.0061	0.0089	0.0075*	0.0011
Lab	34	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	35	<0.030	<0.030	<0.030	<0.030	<0.030	-	-
Lab	36	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Lab	37	0.0228	0.0225	0.0239	0.0227	0.0227	0.0229	0.0006
Lab	38	0.0218	0.0230	0.0227	0.0237	0.0240	0.0230	0.0009

Lead

Sample C
mg/L

							Mean	Standard Deviation
Lab	1	0.048	0.064	0.046	0.052	0.055	0.053	0.007
Lab	2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	3	0.06	0.06	0.06	0.06	0.06	0.06	0.00
Lab	4	0	0	0	0	0	-	-
Lab	5	0.0680	0.0604	0.0551	0.0575	0.0646	0.0611	0.0052
Lab	6	0.077	0.068	0.063	0.083	0.073	0.073	0.008
Lab	7	0.05018	0.04475	0.04543	0.04340	0.04420	0.0456	0.0027
Lab	8	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Lab	9	0.06	0.05	<0.05	0.06	0.08	0.06	0.01
Lab	10	0.06	0.09	<0.02	0.04	<0.02	-	-
Lab	11	0.055	0.055	0.055	0.055	0.055	0.055	0.000
Lab	12	0.05	0.04	0.04	0.04	0.04	0.04	0.00
Lab	13	0.064	0.060	0.058	0.060	0.064	0.061	0.003
Lab	14	0.071	0.066	0.063	0.073	0.060	0.067	0.005
Lab	15	0.07	0.07	0.07	0.07	0.07	0.07	0.00
Lab	16	0.052	0.039	0.047	0.035	0.042	0.043	0.007
Lab	17	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	18	0.05	0.04	0.04	0.05	0.05	0.05	0.01
Lab	19	0.050	0.075	0.075	0.075	0.075	0.070	0.011
Lab	20	0.06	0.062					
Lab	21	0.04	0.05	0.05	0.05	0.05	0.05	0.00
Lab	22	0.0600	0.0600	0.0613	0.0600	0.0545	0.0592	0.0027
Lab	23	0.036	0.032	0.037	0.035	0.036	0.035	0.002
Lab	24	0.087	0.065	0.104	0.080	0.053	0.078	0.020
Lab	25	0.015	0.02	0.005	0.005	0.005	0.010*	0.007
Lab	26	0.070	0.076	0.069	0.074	0.068	0.071	0.003
Lab	27	0.0550	0.0537	0.0462	0.0538	0.0529	0.0523	0.0035
Lab	28	0.080	0.082	0.080	0.084	0.080	0.081	0.002
Lab	29	0.07	0.11	0.11	0.07	0.09	0.09*	0.02
Lab	30	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	31	0.08	0.06					
Lab	32	0.068	0.063	0.066	0.056	0.060	0.063	0.005
Lab	33	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	-	-
Lab	34	0.07	0.14	<0.05	0.10	0.13	0.11*	0.03
Lab	35	0.059	0.049	0.035	0.063	0.055	0.052	0.011
Lab	36	0.03	0.03	0.03	0.03	0.03	0.03*	0.00
Lab	37	0.0577	0.0568	0.0574	0.0571	0.0574	0.0573	0.0003
Lab	38	0.0640	0.0626	0.0643	0.0627	0.0640	0.0635	0.0008

Lead

Sample D

mg/L

							Mean	Standard Deviation
Lab	1	0.120	0.112	0.115	0.109	0.117	0.115	0.004
Lab	2	0.1	0.1	<0.1	<0.1	<0.1	-	-
Lab	3	0.12	0.12	0.12	0.12	0.13	0.12	0.00
Lab	4	0	0	0	0	0		
Lab	5	0.101	0.106	0.105	0.112	0.115	0.108	0.006
Lab	6	0.125	0.123	0.111	0.126	0.146	0.126	0.013
Lab	7	0.100	0.100	0.100	0.110	0.095	0.101	0.005
Lab	8	<0.1	<0.1	0.19	0.15	0.11	-	-
Lab	9	0.10	0.10	0.10	0.08	0.11	0.10	0.01
Lab	10	0.44[D]	0.19	0.14	0.21	0.22	0.24*	0.12
Lab	11	0.123	0.123	0.121	0.123	0.123	0.123	0.001
Lab	12	0.13	0.11	0.13	0.14	0.12	0.13	0.01
Lab	13	0.124	0.114	0.118	0.122	0.120	0.120	0.004
Lab	14	0.121	0.123	0.127	0.130	0.120	0.124	0.004
Lab	15	0.14	0.14	0.12	0.14	0.12	0.13	0.01
Lab	16	0.11	0.083	0.091	0.067	0.090	0.088	0.016
Lab	17	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	18	0.07	0.10	0.10	0.06	0.09	0.08*	0.02
Lab	19	0.125	0.125	0.125	0.125	0.125	0.125	0.000
Lab	20	0.16	0.125					
Lab	21	0.10	0.10	0.10	0.11	0.11	0.10	0.01
Lab	22	0.120	0.110	0.116	0.115	0.117	0.116	0.004
Lab	23	0.044	0.042	0.040	0.046	0.047	0.044*	0.003
Lab	24	0.15	0.15	0.16	0.16	0.14	0.15	0.01
Lab	25	0.025	0.04	0.04	0.035	0.035	0.035*	0.006
Lab	26	0.124	0.129	0.125	0.122	0.122	0.124	0.003
Lab	27	0.115	0.106	0.102	0.104	0.103	0.106	0.005
Lab	28	0.146	0.152	0.140	0.144	0.144	0.145	0.004
Lab	29	0.12	0.16	0.14	0.14	0.14	0.14	0.01
Lab	30	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Lab	31	0.1	0.13					
Lab	32	0.120	0.119	0.112	0.107	0.108	0.113	0.006
Lab	33	<0.03	<0.03	<0.03	<0.03	<0.03	-	-
Lab	34	0.14	0.24	0.25	0.31	0.18	0.22*	0.07
Lab	35	0.139	0.159	0.087	0.111	0.109	0.121	0.028
Lab	36	0.10	0.08	0.10	0.10	0.08	0.09	0.01
Lab	37	0.114	0.115	0.115	0.115	0.114	0.115	0.001
Lab	38	0.119	0.123	0.124	0.124	0.126	0.123	0.003

Appendix C
Individual Laboratory Evaluation

A system to evaluate individual laboratory performance was developed and the results are reported in the following tables. The first letter of the codes refers to accuracy and the second to precision.

ACCURACY

E - excellent accuracy: all replicate values are within the established confidence intervals.

G - good accuracy: the mean of the replicates is within the confidence interval, but one or more replicate values are outside.

L - low result: the mean of the replicates is less than the lower confidence limit.

H - high result: the mean of the replicates is greater than the upper confidence limit.

< - less than value reported

I - insensitive: less than value reported is two times greater than the accepted mean.

- - no result reported or evaluation not possible with submitted results.

PRECISION

P - precise: relative standard deviation (RSD) is within ±10% for samples C and D; ± 20% for sample B.

N - not precise: RSD does not meet above criteria.

- - precision not calculated

examples: EP - excellent accuracy, precise
LN - low mean, not precise

Individual Labortory Evaluation

Lab	Al			V		Cr			Co			Ni			Cu	
	B	C	D	C	D	B	C	D	B	C	D	B	C	D	C	D
1	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
2	I-	<-	EP	--	--	<-	HP	EB	I-	I-	I-	<-	EP	EP	EP	EP
3	EP	EP	EP	EN	EP	EP	EP	EP	<-	EP	EP	EP	EP	EP	EP	EP
4	I-	I-	I-	--	--	HN	HN	HP	--	--	--	L-	HP	HP	EP	HP
5	HP	HN	HP	--	--	EP	EP	EP	HP	EP	EP	HP	HP	HP	GP	EP
6	--	--	--	--	--	<-	<-	GN	GN	EN	EP	GP	GP	EP	EN	EP
7	EP	EP	EP	--	--	EP	EP	EP	--	--	--	EP	EP	EP	EP	EP
8	HP	HP	HP	I-	I-	EN	EN	EP	GN	HN	GN	<-	GP	EP	EP	EP
9	EN	GP	HP	EP	EP	EP	HP	GN	<-	HP	EP	EP	EP	EP	EP	EP
10	--	--	GP	HN	EP	<-	<-	GN	<-	<-	GP	<-	HP	HP	EP	EP
11	HN	EP	EP	EP	EP	<-	EP	EP	EP	EP	EP	EP	EP	EP	EN	EP
12	<-	EN	GP	--	--	EP	EP	EP	--	--	--	<-	EP	EP	EN	EP
13	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
14	EN	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
15	HP	HP	HP	EP	EP	<-	<-	EN	<-	<-	<-	<-	EP	EP	LP	GP
16	EN	EN	EP	--	--	EN	EN	EP	EP	EN	GN	EP	EP	GN	EP	EP

Lab	Al			V		Cr			Co			Ni			Cu	
	B	C	D	C	D	B	C	D	B	C	D	B	C	D	C	D
17	HP	EP	LP	HP	GP	<-	<-	<-	<-	<-	<-	EP	EP	EP	HP	HP
18	EN	EP	EP	GN	GN	<-	<-	GN	<-	GN	EP	EP	EP	GP	<-	EP
19	--	--	--	--	--	EP	EP	EP	EP	EP	EP	GP	EP	EP	EP	EP
21	EP	EP	EP	EP	EP	EP	EP	EP	<-	<-	<-	EP	EP	EP	EP	EP
22	<-	EP	EP	I-	<-	<-	GP	EP	I-	<-	EP	EP	EP	EP	EN	EP
23	I-	HP	EP	I-	<-	EP	EP	EP	<-	EP	EP	EP	HP	EP	EP	EP
24	EN	EP	EP	--	EP	GN	GP	EN	GN	EP	EN	GN	GP	GP	GN	EN
25	EP	LP	LN	EP	EP	EN	GN	EP	GP	EP	EN	HP	LN	LP	LP	EP
26	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	HP	EP	EP	EP	EP
27	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
28	EP	EP	EP	--	EP	EP	EP	EP	HP	EP	EP	EP	EP	EP	EP	EP
29	HP	HP	HP	EP	EP	<-	<-	GN	<-	<-	EN	EN	EP	EP	LP	GP
30	HP	EP	LP	HP	EP	<-	<-	<-	<-	<-	<-	EP	EP	EP	HP	HP
32	--	--	--	GP	EP	EP	EP	EP	EN	EP	EP	EP	EP	EP	EP	EP
33	EP	LP	EP	<-	GN	EP	LP	GN	EN	LP	LP	GP	EP	EP	EP	EP
34	<-	GN	EP	<-	<-	I-	<-	HN	I-	<-	<-	<-	EP	EP	EP	EP
35	EP	EP	EP	EP	EP	<-	<-	EN	<-	<-	GN	<-	EP	GP	EP	EP
36	<-	EP	EP	<-	HP	<-	<-	EP	EP	EN	EP	HP	HP	HP	EP	EP

Individual Laboratory Evaluation (con't)

Lab	Zn				Mo			Ag		Cd			Pb		
	A	B	C	D	B	C	D	C	D	B	C	D	B	C	D
1	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP	GP	EP	EP
2	<-	EP	EP	LP	--	--	--	<-	EP	I-	EP	EP	<-	<-	<-
3	EP	EP	EP	EP	<-	EP	EP	<-	<-	GN	EP	EP	EN	EP	EP
4	L-	HP	HP	EP	--	--	--	HP	HP	HP	HP	HN	I-	I-	I-
5	EP	HP	EP	EP	I-	I-	I-	--	--	EP	EP	HP	EP	EP	EP
6	HP	EP	EP	EP	<-	<-	<-	--	--	GP	EP	EP	HP	EP	EP
7	HP	GP	EP	EP	--	--	--	EP	EP	EP	EN	HN	EP	EP	EP
8	HN	HP	EP	EP	I-	<-	<-	<-	<-	GN	EP	HN	<-	<-	<-
9	<-	EP	EP	EP	<-	EN	EN	EP	EP	<-	EP	EP	<-	GN	GP
10	<-	HP	HP	GP	<-	<-	<-	<-	<-	<-	<-	HN	<-	<-	HN
11	<-	EP	LP	EP	EP	EP	EN	--	--	HP	EP	EP	EP	EP	EP
12	HN	HP	EP	EP	--	--	--	HP	HP	HP	EP	HP	GP	EP	EP
13	EP	EP	EP	EP	EP	EP	EP	LN	LN	EN	EP	EP	EP	EP	EP
14	EP	EP	EP	EP	EP	EP	EN	EP	EP	EP	EP	EP	EP	EP	EP
15	<-	GP	EP	EP	<-	<-	<-	<-	<-	I-	EP	HN	<-	EP	EP
16	GN	EN	LP	EP	HN	HP	HN	EN	EP	GN	EP	HP	GN	EP	GN

Lab	Zn				Mo			Ag		Cd			Pb		
	A	B	C	D	B	C	D	C	D	B	C	D	B	C	D
17	<-	EP	EP	EP	I-	I-	I-	<-	<-	I-	<-	<-	<-	<-	<-
18	<-	EP	EP	EP	<-	<-	EP	<-	<-	I-	EP	EP	<-	EP	LN
19	EP	EP	EP	EP	--	--	--	EP	EP	EN	EP	GP	GP	EP	EP
21	<-	EP	LP	LP	EP	EP	EP	<-	<-	GN	GN	LN	<-	EP	EP
22	EP	EP	EP	EP	I-	<-	<-	HP	HN	HP	EP	EP	EP	EP	EP
23	HN	HP	HP	EP	<-	<-	<-	<-	EN	HP	GP	HP	EP	GP	LP
24	HP	HP	EP	EP	<-	EP	GN	<-	<-	<-	EP	LN	<-	GN	HP
25	LP	LN	LN	LN	GP	EP	EN	EP	GN	HP	EN	LP	<-	LN	LN
26	GP	EP	EP	EP	EP	EP	EP	--	--	HP	EP	EP	GP	EP	EP
27	EP	EP	EP	EP	EP	EP	HP	EP	EP	EP	EP	EP	EP	EP	EP
28	EP	EP	LP	EP	HP	GP	HP	EP	EP	EP	EP	EP	HP	EP	EP
29	<-	EP	EP	EP	<-	<-	<-	<-	<-	I-	EP	EP	<-	HN	GP
30	<-	EP	EP	EP	I-	I-	I-	<-	<-	I-	<-	<-	<-	<-	<-
32	<-	EP	EP	EP	--	--	--	--	--	<-	EP	EP	GP	EP	EP
33	EP	EP	EP	EP	EP	EP	EP	<-	HP	EP	EN	EP	LP	<-	<-
34	I-	<-	HP	EP	<-	<-	<-	I-	I-	<-	<-	LN	<-	HN	HN
35	<-	LP	EP	HP	<-	LP	LN	<-	<-	<-	<-	<-	<-	EP	EN
36	EP	EP	EP	EP	<-	<-	<-	HN	EP	HP	EP	HP	<-	LP	EP

Appendix D
Correspondence

November 15, 1990.

2~

Dear 3~

Re: Pre-MISA Laboratory Assessment - Sewage Treatment Plant Effluent Program
Metals Analysis

Further to the letter of November 1 from Peter G. Sly of CAEAL, this laboratory has undertaken the responsibility for the metals analysis portion of this study. We understand that your laboratory has agreed to participate.

We have collected a sample of chlorinated sewage treatment plant (STP) effluent for trace metal determinations at the Ottawa-Carleton Robert O. Pickard sewage plant in Gloucester, Ontario. The sample was immediately filtered through 0.45 and 0.2 um filters and acidified to pH 1.6 with ultrapure nitric acid.

The material was divided into four portions, three of which were spiked to various concentration levels for the 13 elements of interest to the Ontario Ministry of the Environment. The elements are Ag, Al, Be, Cd, Co, Cr, Cu, Mo, Ni, Pb, Tl, V, and Zn.

We intend to ship 500 ml portions of each of the four samples to you within the next few days by post. You will be asked to perform five replicate analyses on each sample and return your results and other information to us on the supplied forms by January 7, 1991. We cannot guarantee that data received after this date will be included in the final report.

Soon after the deadline date you will receive a copy of all the raw data and you will be asked to confirm that we have made no errors in the transposition of your data. All sample data will be coded and confidentiality is absolutely assured.

.../2

We will also analyze these samples in this laboratory by a variety of methods in a manner akin to our certification process for our certified natural water reference materials. In this way we will be able to ensure that the metal concentrations are reliably known and we will be better able to estimate any biases in your results.

Our deadline for a full report to CAEAL which will include estimates of each participant's variance and bias for each of the metals at the various concentrations is March 15, 1991. We anticipate that you will receive a copy of this report from the Ontario Ministry of the Environment not long thereafter.

If your procedures require more than 500 ml for five replicate analyses, please let us know and we will ship a second set.

If you have not received your samples by Nov. 28 please contact Scott Willie by phone (613-993-2359) or fax (613-993-2451).

Yours sincerely,

Shier Berman
Head, Measurement Science

November 16, 1990

2~

Dear 3~

Enclosed are four bottles of filtered sewage treatment plant (STP) effluent for trace metal determinations as part of the CAEAL\OME Pre-MISA laboratory assessment for metal analyses. Three of the four bottles have been spiked to various levels for the thirteen elements of interest to the Ontario Ministry of the Environment. The elements are Ag, Al, Be, Cd, Co, Cr, Cu, Mo, Ni, Pb, Tl, V and Zn.

Please perform five replicate analyses on each sample and record your results on the data sheets provided along with the date of each analysis and your estimated limit of detection for each metal. Submit five results, no more, no less. If more than five results are submitted only the first five will be included in the report. Any set with less than five results will be ignored.

On the cover sheet please briefly describe the procedure that you have used (i.e., sample preparation, instrumental method, etc.). Do not just provide a reference. If for any particular metal your procedure deviates from the general described method there is room on the individual data sheet for remarks. Also, please tell us what reference material or standards you used, how you calculate a limit of detection and whether you normally analyze STP effluents.

Results must be returned to this laboratory by mail or fax by January 7, 1991 or we cannot guarantee that they will be included in the report. Shortly after the deadline you will receive a copy of all the raw data submitted and you will be asked to confirm that we have made no errors in the transposition of your data. We will change data only if we have made an error. All sample data will be coded and confidentiality is absolutely assured.

If you need more samples please contact Scott Willie by phone (613) 993-2359 or fax (613) 993 2451 as soon as possible. We have only a limited supply of extra bottles.

Shier Berman
Head, Measurement Science

Aluminum

Concentration Units _____

Date	Sample A	Date	Sample B	Date	Sample C	Date	Sample D
____	_____	____	_____	____	_____	____	_____
____	_____	____	_____	____	_____	____	_____
____	_____	____	_____	____	_____	____	_____
____	_____	____	_____	____	_____	____	_____
____	_____	____	_____	____	_____	____	_____
Mean	_____		_____		_____		_____
Std. Dev.	_____		_____		_____		_____

Do you regularly analyze for this element? _____

Limit of Detection _____

Remarks _____

_____

_____